MARCH 18, 1933

Railway Age

FOUNDED IN 1856

GENEVA C... BEAVER FALLS, PA.

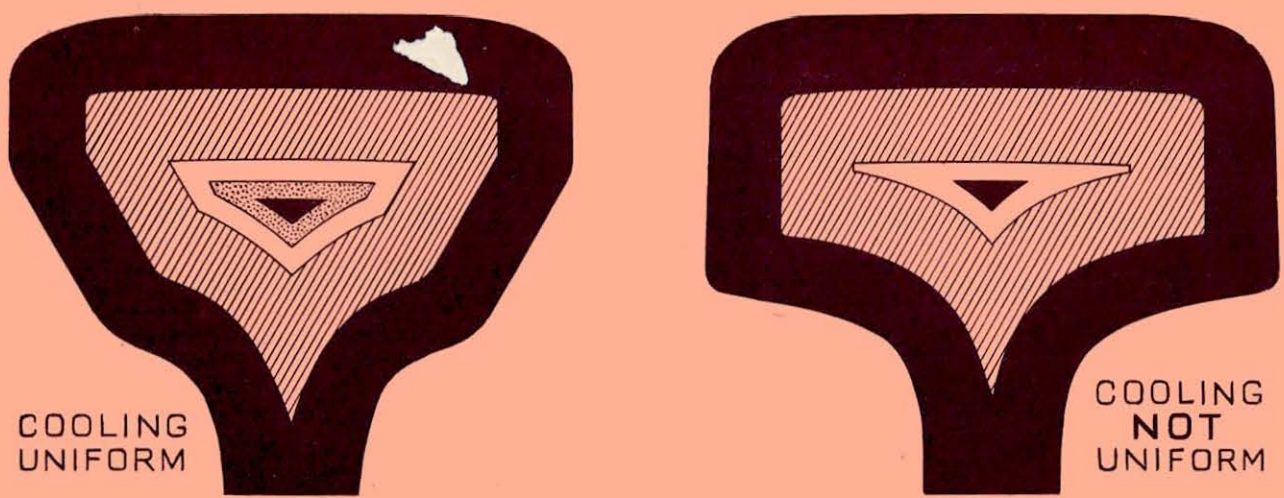
COMMON SENSE

Only requirement to select best rail design.
Familiarity with mass of technical data not required.

Since we all first knew of the Tee Rail Section we have heard that increased number of passes in rolling gave the steel in rail head a better working and resulted in better rail.

Impossible for steel in head of Tee rail to be worked as well as in head of

HEADFREE RAIL.



Uniform cooling of rail head means less strains set up while cooling and results in better structure of steel (Pearlite grain).

Other variables, such as temperature at which rail is rolled and rate of cooling, bear directly on rail quality.

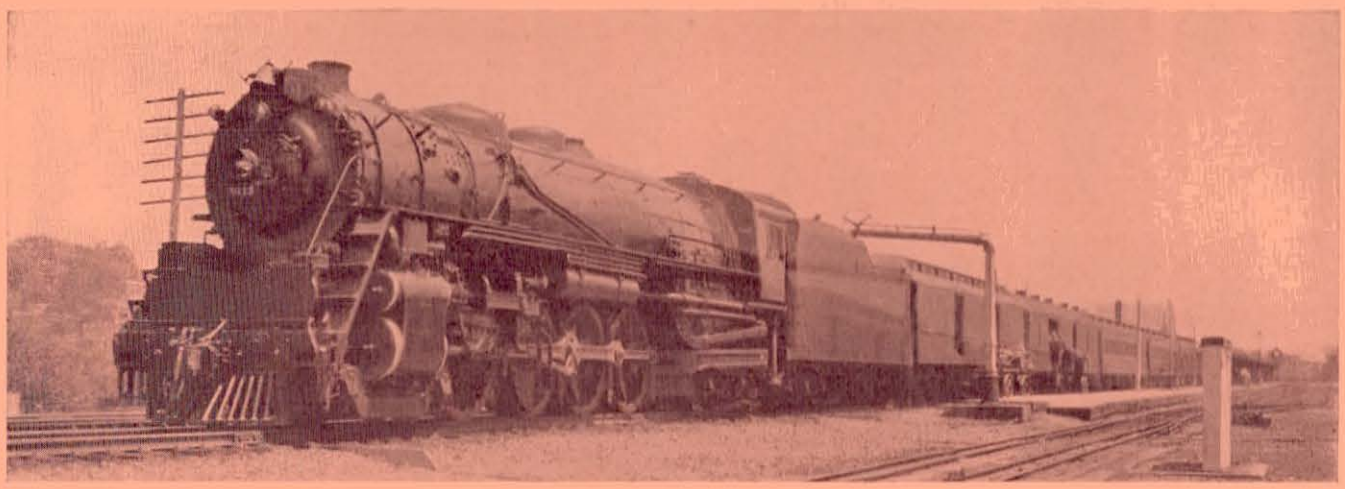
But

Well worked steel and uniform cooling are requisites of good rail.

THE THOMSON RAIL CORPORATION OF N. Y.

Pat'd U. S. A. & CANADA

Pennsylvania Building, Philadelphia, Pa.



What Is A Serviceable Locomotive?

Since 1929, the average speed of freight trains has increased more than 17 per cent. Many of the freight locomotives in service today are running 100,000 to 125,000 miles between heavy repairs, as compared with 50,000 to 60,000 miles which is the limit for many locomotives over ten years old.

These improvements in service have been accompanied by a constantly decreasing amount of fuel required to move 1,000 tons of cars and freight one mile—this figure having shown a 3.5 per cent drop since the year 1929.

These results have been possible principally because today's traffic is being moved with the best 60 per cent of the locomotive inventory.

The remaining 40 per cent of the inventory, consisting of the older and more obsolete locomotives, is in storage or awaiting repairs. This 40 per cent cannot compete with modern locomotives and should never be returned to service.

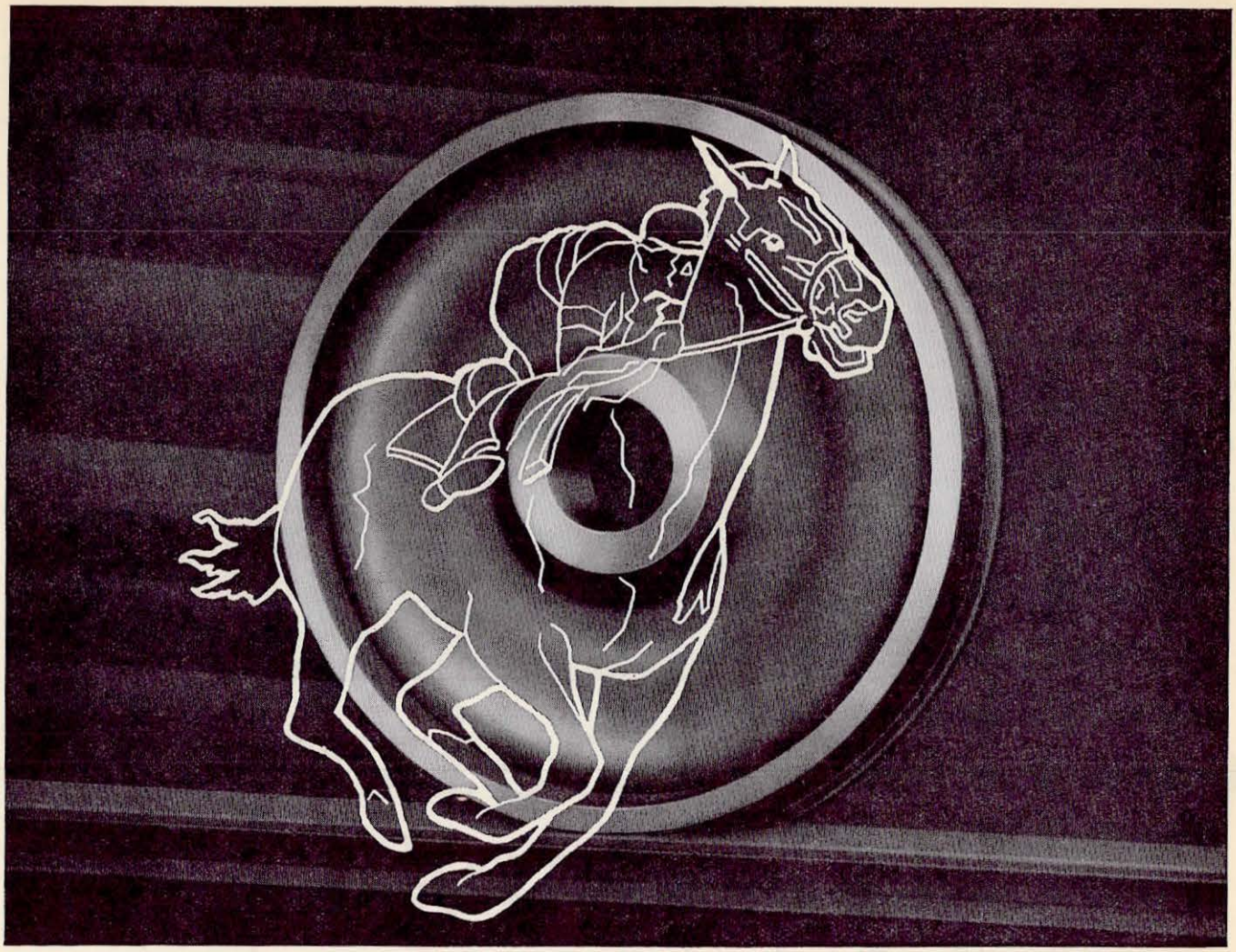
But beyond that, the road to increased earnings lies in retiring much of the obsolete power still in operation and replacing with modern locomotives.

It takes Modern Locomotives to make money these days!

THE BALDWIN LOCOMOTIVE WORKS

PHILADELPHIA

Published weekly by Simmons-Boardman Publishing Company, 1309 Noble Street, Philadelphia, Pa. Entered as second class matter, January 4, 1933, at the Post Office at Philadelphia, Pa., under the act of March 3, 1879.



A ONE-WEAR WHEEL THAT STAYS IN THE HOMESTRETCH

WHEN ordinary wheels begin to weaken under the hard daily grind, Armco ONE-WEAR Wheels are just hitting their stride. Such stamina means *plus mileage* to you. And it is built into every wheel—the same good quality of steel; the same degree of hardness below the condemning limit as above; the same vital factor of safety in the homestretch as at the turn. Your light equipment rolls fast and can be kept rolling long and profitably with Armco Wheels. Shall we explain through our nearest office?

ARMCO
WHEELS • SHEETS • PLATES
for *thrifty* railroads

THE ARMCO RAILROAD SALES CO.

Subsidiary of
The American Rolling Mill Company

Executive Offices: Middletown, Ohio

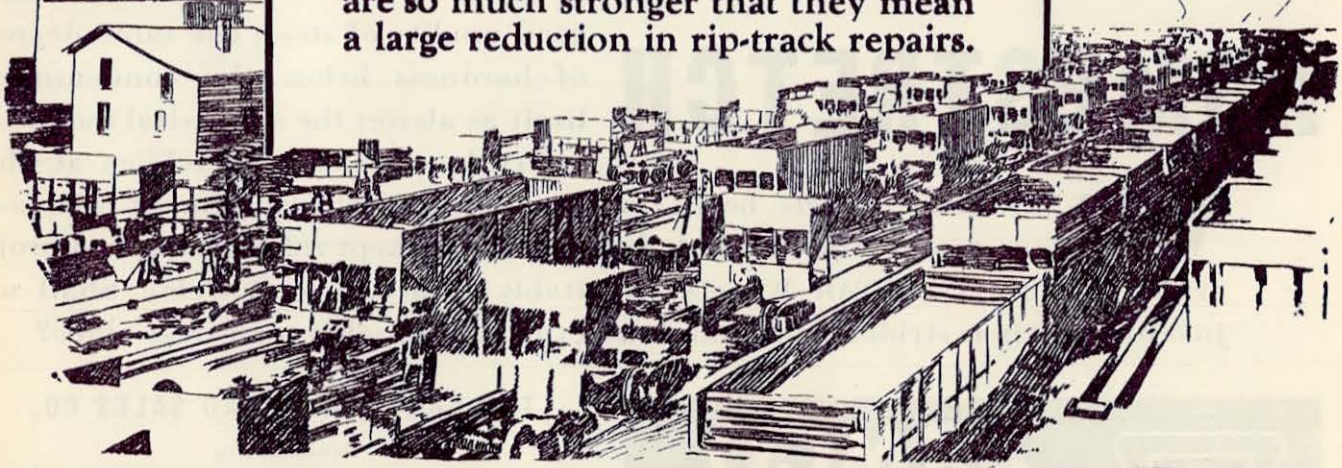
DISTRICT OFFICES: Chicago . Cleveland . New York
Philadelphia . St. Louis . San Francisco

Expensive Carding

Flat plate doors mean frequent carding to rip-tracks.

AJAX
CORRUGATED
DROP DOORS

are so much stronger that they mean a large reduction in rip-track repairs.



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Railway Age

With which are incorporated the Railway Review, the Railroad Gazette and the Railway Age-Gazette. Name Registered U. S. Patent Office.

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A special section devoted to a report of the annual convention of the A. R. E. A., including also a pictorial review of current developments in the field of appliances and materials used in railway construction, maintenance and signaling.

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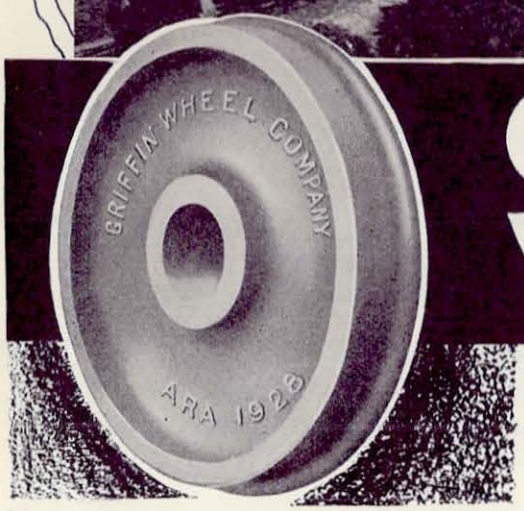


GRIFFIN WHEELS

UNPARALLELED ADVANCE

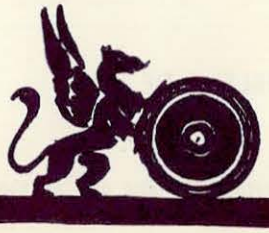
THE RAPID STRIDES IN THE IMPROVEMENT OF THE CHILLED TREAD WHEEL HAVE FAR EXCEEDED THE INCREASED SPEED IN TRAIN SCHEDULES AND SEVERITY OF SERVICE.

THE PAST TWO YEARS OF CLOSER OBSERVATION IN RAILROAD OPERATIONS HAVE DEFINITELY PLACED THE SINGLE PLATE CHILLED TREAD WHEEL AS THE UNIVERSAL STANDARD FOR ALL FREIGHT AND REFRIGERATOR CARS.

Griffin Plants Conveniently Located

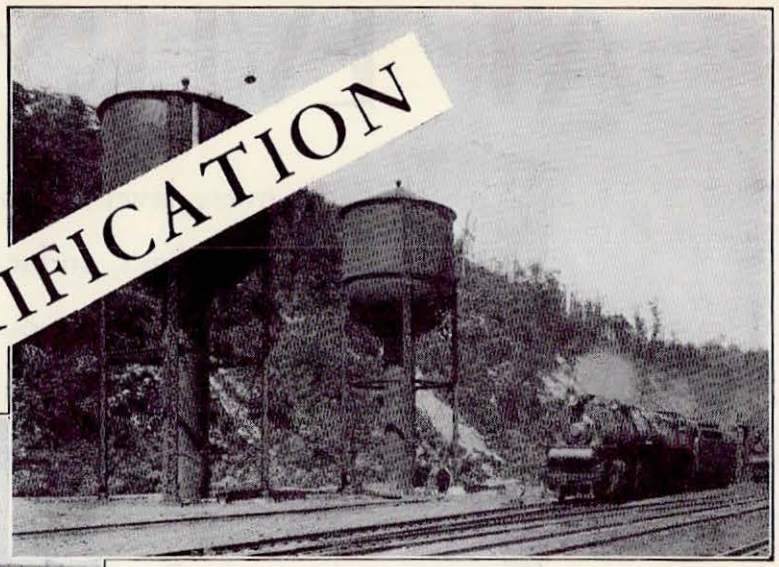
Chicago	Detroit
Cleveland	Cincinnati
Boston	St. Paul
Kansas City	Tacoma
Council Bluffs	Denver
Los Angeles	Salt Lake City

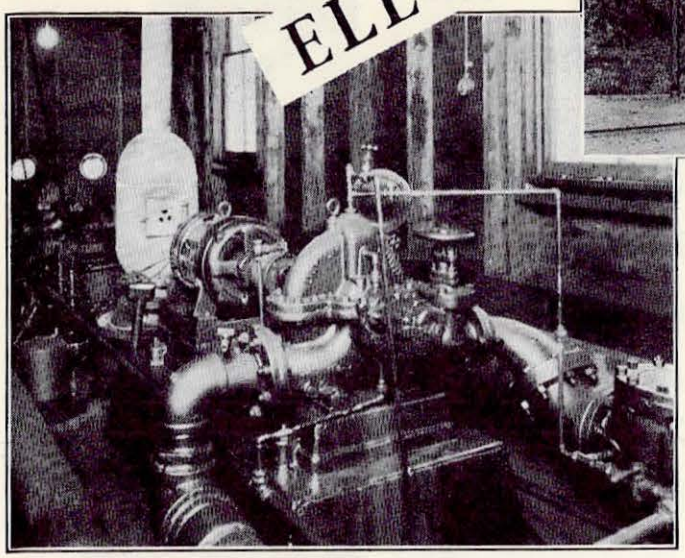
THE FOOD SUPPLY OF THE NATION IS CARRIED ON CHILLED TREAD WHEELS



GRIFFIN WHEEL COMPANY
410 N. Michigan Ave.,
Chicago, Ill.

WATER SERVICE ELECTRIFICATION





Interior of wayside pumping station. The two 300-gallon per minute centrifugal pumps are each driven by 15-hp. Westinghouse Motors.

REDUCES

Pumping Costs

50%

One of a series of advertisements featuring self-liquidating modern improvements that many railroads are applying to reduce costs in shops, maintenance of way, and signaling operations.

IN order to secure water of more satisfactory quality, a large Mid-Western railroad after a study of its water service facilities, developed an electrified pumping system located four miles from its tracks.

As a result of electrification, the cost of pumping water is now less than half of that for the plant previously in service near its tracks . . . and the quality of water is so far superior that the old treating plant has been abandoned.

This pumping station requires no attention other than a fortnightly inspection. It is entirely automatic.

Modern automatic electrical equipment permits the development and economical operation of plants at the sources of the most desirable water. Electrification also eliminates costly fuel deliveries. This is one of the most worthwhile opportunities that modernization offers to railroads today for reducing operating costs.

Westinghouse has a complete line of motors, automatic control and other electrical apparatus applicable to the electrification of water service. An experienced engineer will assist you without obligation in making an economic analysis of your water service stations.

Westinghouse

Quality workmanship guarantees every Westinghouse product

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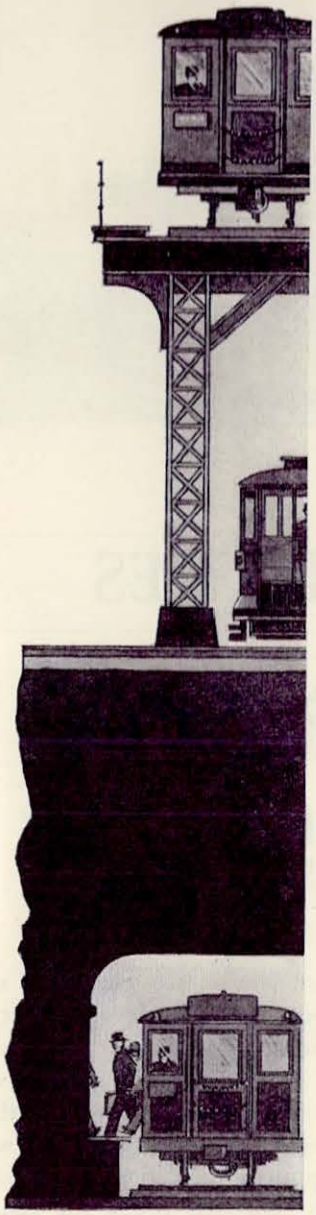
MAIL THE COUPON

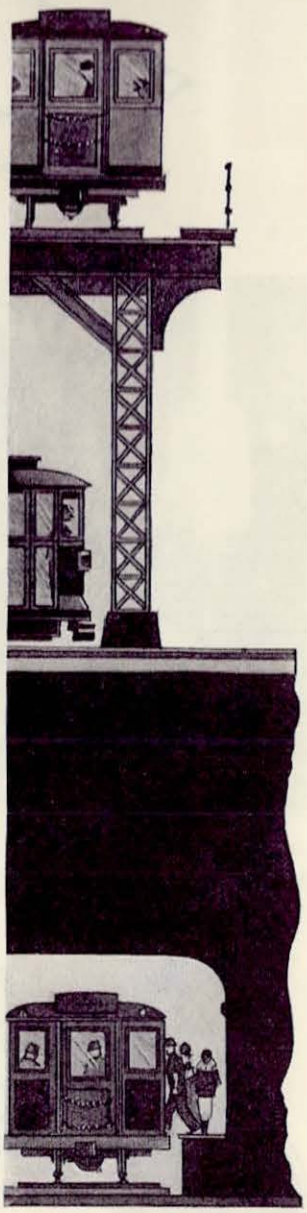
Westinghouse Electric & Manufacturing Company
Room 2-N—East Pittsburgh, Pa.
Gentlemen:
Please send me your literature on Water Service Modernization.
Name .....
Company .....
Address .....
City ..... *State* ..... RA 3-18-33

Tune in the thrilling new Westinghouse serial radio mystery by OCTAVUS ROY COHEN . . . N.B.C. Network

AT EVERY LEVEL



At every level of operation — elevated lines, surface cars or subways — there you will find "Standard" Wrought Steel Wheels. NEARLY two billion wheel miles, carrying the Interborough Rapid Transit Company's 1,261,904,518 passengers or on many other heavy-traffic lines, have proved that "Standard" Wheels *do* give more wear with longer intervals between replacement. At whatever level you operate there is only one level of economy — the lowest cost per wheel mile represented by the cost of a "Standard" Wheel.



STANDARD STEEL WORKS COMPANY

SUBSIDIARY OF THE BALDWIN LOCOMOTIVE WORKS

GENERAL OFFICES & WORKS: BURNHAM, PA.

NEW YORK CHICAGO PORTLAND AKRON

PHILADELPHIA ST. LOUIS SAN FRANCISCO

Built for TODAY'S RAILROADING CONDITIONS

P C & M C AIR CONDITIONING equipment costs less to operate than any other system

Air conditioning of railway equipment is in its infancy. Actual service experience with the various air conditioning systems now available will lead to mechanical improvements. These improvements will bring a greater degree of operating certainty — fewer failures. Eventually one type of equipment will be about as mechanically dependable as another.

It is apparent, therefore, that choice of air conditioning equipment will ultimately favor *the* system that is *most economical to operate. That* system, and only *that* system, will be considered the best.

The **PC&MC** AIR CONDITIONING system is the most economical to operate. It is the simplest mechanically. It absorbs less locomotive power than any other system. It is the only system which eliminates the power losses of the generator drive; no loss from generator to battery, from battery to motor, from motor to compressor.

More than 5 million car miles of successful operating experience on various types of passenger-carrying cars on several different railroads have proved **PC&MC** installations the best the market affords today on both major counts — *operating economy* and *mechanical dependability.*

These facts are worthy of every railway executive's thorough consideration. Car mile costs are vital. May we show you why **PC&MC** AIR CONDITIONING equipment offers a better financial return on your investment than any other system?

P C & M C OPERATING ADVANTAGES

1 The **PC&MC** system has fewer moving parts, which assures dependable simplicity.

2 The **PC&MC** system is backed by 7 years of engineering research—plus 5 million car miles of actual operating experience.

3 Other systems of equivalent capacity absorb *30% to 67% more locomotive power* than **PC&MC.**

4 Other systems are 50% to 110% heavier in weight than **PC&MC.**

PULLMAN CAR & MANUFACTURING CORPORATION

General Offices: Chicago, Illinois

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Washington Sales Office:
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Birmingham Sales Office:
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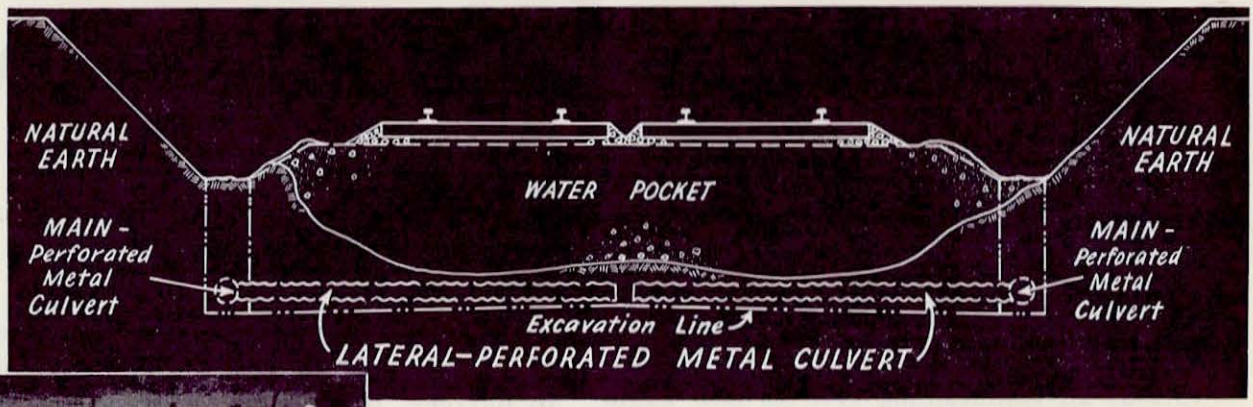
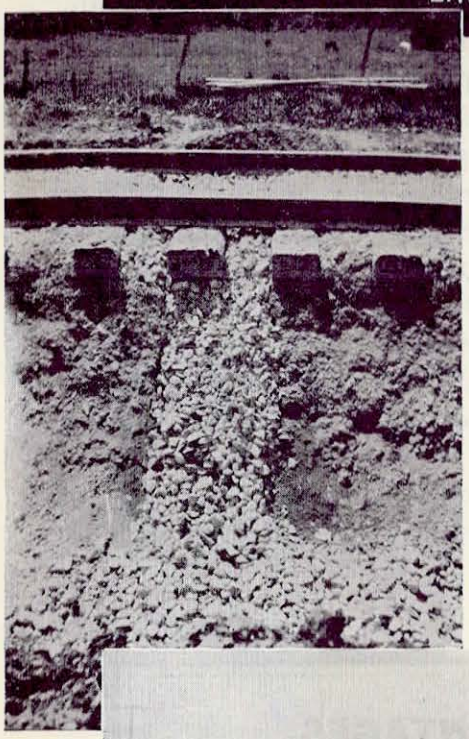
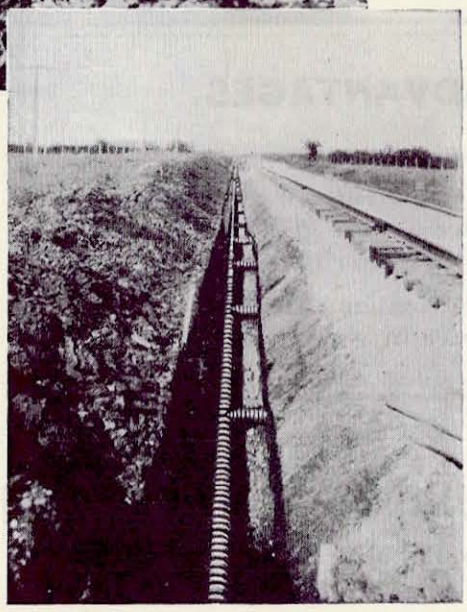
USE TONCAN IRON CULVERTS FOR WATER POCKET DRAINAGE IN CUTS







When the track is unstable and will not carry its grade or alignment through cuts, the cause is generally defective drainage. Water seepage from drainage ditches and rainwater are retained in water pockets, making a plastic mass which absorbs the ballast under the ties. Around the ties, especially at joints, water and mud are often pumped to the surface under heavy traffic.

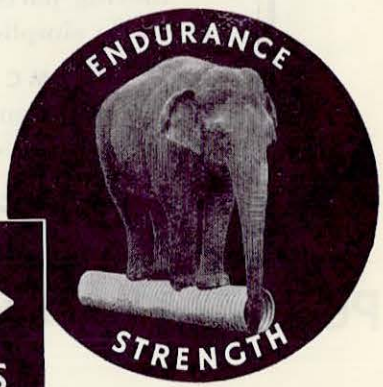
The remedy is a series of Toncan Iron Perforated Culverts installed through the cut. Mains, paralleling the track, are laid well below the level of water pockets. Laterals are laid at intervals of twenty feet under and at right angles to the track and connected to the mains. Back-fill may be stone, gravel or slag.

Such a system of Toncan Iron Culverts will restore the track to a stable condition and, because Toncan Iron is a rust-resisting alloy of refined iron, copper and molybdenum, it will last for years. And because of its flexibility it will not fail under the vibration and pounding of heavy traffic. It will reduce maintenance costs, and prove far more economical than less scientifically designed drains.

Additional information gladly supplied upon request.

Upper view—Lateral, showing perforated culvert in place with back-fill of crushed stone.

Lower view—Main, showing perforated culvert to which laterals connect, before back-filling.

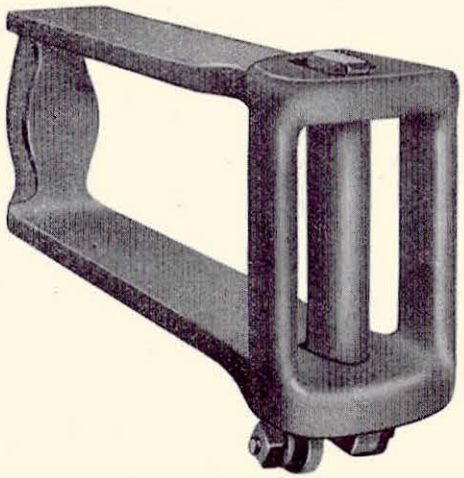


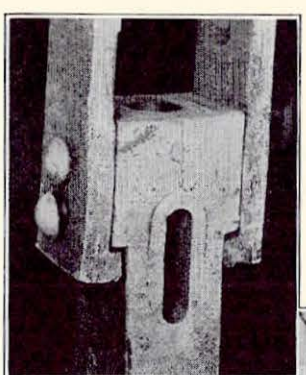
REG. U.S. PAT. OFF.
TONCAN
IRON CULVERTS

TONCAN CULVERT MANUFACTURERS' ASSOCIATION • YOUNGSTOWN, OHIO

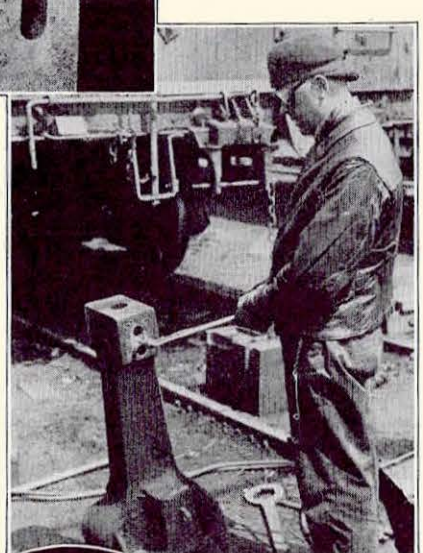
JANNEY

VERTICAL CAST STEEL COUPLER YOKE

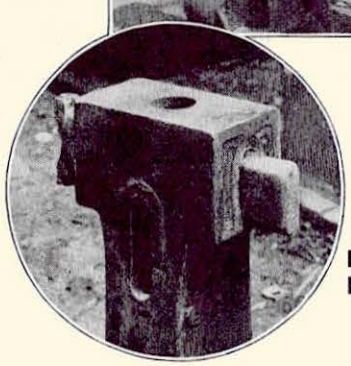




LOOSE RIVETS



BURNING OUT BRIDGE



KEY IN PLACE

Thousands of wrought riveted yokes previously applied to freight equipment of the American Railroads have been replaced with Janney Yokes, eliminating the heavy maintenance expense arising from loose yoke rivets.

When a wrought yoke is replaced with a Janney Vertical Yoke, the original coupler is again used, the bridge of metal between the rivet holes in the butt being burnt out to form the Janney key slot.

The heavy vertical forged steel key used with the Janney Yoke fits into the slot formed when the bridge between the rivet holes of the coupler shank is burnt out, and is the dependable connection between the coupler and yoke.

The Janney Vertical Key Yoke permits quick and easy changing of couplers.

AMERICAN STEEL FOUNDRIES

NEW YORK CHICAGO ST. LOUIS

TWENTY years of continuous service without maintenance on a double sheathed wood car.

There's a practical demonstration of the economic value of the Universal Dry Lading Roof. This lasting service is undisputable evidence of its correctness of design, the durability of its parts and the economy of its weatherproof operation. It expresses the value of Dry Lading Roofs in terms of long trouble-free service and dollars and cents savings.

There is no mystery about this unusual service. It's all in the design. The roof sheets are adjustable as to other parts and with the car structure. Unlike the riveted roof, this adjustability allows for vibration, so that the sheets will yield and not bulge or break under strain.

Hutchins Car Roofing Company

RAILWAY AGE

Railway Interest and Other Costs

Congress has passed a new bankruptcy law which contains provisions especially intended to enable railway companies and their creditors, with the aid of the Interstate Commerce Commission, to effect reductions of indebtedness and fixed charges largely by negotiations and with less resort to receiverships and processes incidental thereto than heretofore. It has been shown repeatedly in the *Railway Age* that the increases made in the indebtedness and fixed charges of the railways within the last two decades, and especially within the last decade, have been much smaller in proportion to new investment than those that have been incurred by most industries and individuals. The increase in railway indebtedness has contributed very little to the large general increase in indebtedness that has occurred in this country since the great war, and because of which the nation is confronted in the depression with some of its most difficult problems. In 1910 railroad indebtedness was 58 per cent of railroad investment; in 1930 only 45½ per cent.

Too Much Financing with Bonds

In a period such as the present, however, there always comes a time when creditors must share in the losses in almost every line of business due to reductions of earning capacity and values, and the conservatism with which the railways have been financed for many years does not alter the plain fact that their fixed charges are too high for such periods as the present and that they have proven too high under similar, but less serious, conditions in the past. For many years spokesmen of the railways have been giving warnings that their fixed charges were too high and that to protect them from widespread disaster they should be allowed to make earnings which would enable them to finance more largely by the sale of stock. These warnings have passed largely unheeded; and railway financiers and managements themselves often have failed to take advantage of favorable conditions to adopt methods of financing by which they might have curtailed fixed charges.

The fact that financing principally with bonds largely increases the net income per share on stock when gross earnings increase has been a temptation to finance largely with bonds; and that net income per share largely increased during the recent years of prosperity, and averaged almost $9 in the five years ending with 1929, was cited as evidence of the prosperity of the railways, and that they needed no larger net earnings, although the return earned on their property investment during the same years averaged only about 4.65 per cent. The effect of relatively excessive fixed charges already, during this depression, has been to throw a number of companies into bankruptcy and to make necessary the saving of numerous others from bankruptcy by loans from the Reconstruction Finance Corporation.

Interest a Small Charge During Prosperity

The statistics given in the accompanying tables show at least two important things. One is that since before the war the increases in other railway costs have been relatively much larger than the increase in interest. The other is that both before and since the war interest charges have become a dangerously large part of total railway costs in periods of reduced earnings.

Railway Interest and Other Costs in Years of Prosperity and Depression

	* 1916 (millions)	Per cent of total operating revenues	1926 (millions)	Per cent of total operating revenues	* 1915 (millions)	Per cent of total operating revenues	1932 (millions)	Per cent of total operating revenues
Total Operating Revenues	$3,691	100.0	$6,621	100.0	$2,956	100.0	$3,221	100.0
Wages	1,403	38.0	2,821	42.6	1,278	43.2	1,540	47.8
Other Oper. Expenses	1,023	27.7	2,028	30.6	811	27.5	941	29.2
Total Oper. Expenses	2,426	65.7	4,849	73.2	2,089	70.7	2,481	77.0
Taxes	164	4.4	413	6.2	139	4.7	293	9.1
Rentals	46	1.3	91	1.4	37	1.2	98	3.1
Operating Expenses, Taxes and Rentals	2,636	71.4	5,353	80.8	2,265	76.6	2,872	89.2
Net Railway Operating Income	1,055	28.6	1,268	19.2	691	23.4	349	10.8
Total Interest	500	13.5	579	8.7	498	16.8	607	18.8
Per Cent Interest of Net Ry. Oper. Inc.	47.4		45.7		72.1		173.9	

* Excludes Switching & Terminal Companies.

The year 1916 was the most prosperous that the railways had before this country entered the war, and the year 1926 was the most prosperous they have had

since the war. In 1916 the interest on their indebtedness was 13.5 per cent of their gross earnings, and in 1926 only 8.7 per cent of them. In 1916, however, wages took only 38 per cent of total earnings, and 42.6 per cent in 1926; other operating expenses, 27.7 per cent in 1916, and 30.6 per cent in 1926; taxes, 4.4 per cent in 1916 and 6.2 per cent in 1926. Operating expenses, taxes and rentals were only 71.4 per cent of gross earnings in 1916, while in 1926 they were 80.8 per cent of them. These figures demonstrate very clearly that *relatively* the smallest increase in costs the railways had in 1926 as compared with 1916 was in the interest on their indebtedness. The increase in annual interest was $79,000,000, while the increase in annual operating expenses and taxes was $2,672,000,000, or almost *thirty-four* times as great. Obviously, therefore, increase in indebtedness and in the interest charge upon it contributed relatively very little toward making necessary higher rates and larger earnings in 1926 than in 1916.

Relative Increase of Interest in Depressions

The most important characteristic of interest, however, is that it is a fixed charge, and that consequently it becomes a much more important factor in costs in years of depression than in years of prosperity. Let us, then, compare statistics for a year of depression before this country entered the war and for a year of depression since the war. Business in the United States was poor when the war began in Europe in 1914, and was made worse by it for a year, and the financial results of railway operation in the year ended June 30, 1915, were the worst that had been reported since the depression of the nineties. At one time in that year railways with 42,000 miles of line were in receivership. The financial results of railway operation in 1932 were the worst in history. In 1915 the interest on the indebtedness of the railways was 16.8 per cent of their gross earnings, and in 1932, 18.8 per cent. The increase in 1932 over 1915 was not relatively very great, but, in 1932, interest was larger in proportion to gross earnings than in any previous year in history. Increases in all other railway costs relative to gross earnings also occurred. Wages took 43.2 per cent of gross earnings in 1915, and 47.8 per cent in 1932; other operating expenses in 1915 were 27.5 per cent of gross, and in 1932, 29.2 per cent; total operating expenses in 1915 were 70.7 per cent of gross, and in 1932, 77 per cent; taxes in 1915 were 4.7 per cent of gross, and in 1932, 9.1 per cent; rentals in 1915 were 1.2 per cent of gross, and in 1932, 3.0 per cent; operating expenses, taxes and rentals combined in 1915 were 76.6 per cent of gross, and in 1932, 89.2 per cent. Total earnings in 1932 were only 9 per cent greater than in 1915; operating expenses were 19 per cent greater; taxes, 111 per cent greater; operating expenses and taxes combined 24 per cent greater, and interest 22 per cent greater. The financial outcome was that in 1915 net operating income was $691,000,000, or 23.4 per cent of gross earnings, while in 1932 it was only $349,000,000, or 10.8 per cent of gross earnings. Total interest in 1915 being $498,000,000, the railways could have paid all of it from net operating income and had $193,000,000 left for other purposes, while in 1932, when total interest was $607,000,000, net operating income was $258,000,000 less than enough to have paid all interest.

An Unseaworthy Financial Structure

Theoretically, the financial structure and assets of any company or industry should be such as to make it reasonably probable that it will be able to weather solvently the worst financial storm that may reasonably be expected to occur. As a practical matter, the financial storm which has raged during the last three years has been worse than anybody ever anticipated would occur. Both recent and previous experience combine, however, to give warning that the present financial structures of many railways are unseaworthy for even less severe storms and that the financial structure of the industry as a whole leaves much to be desired. When the railways in 1926 had gross earnings exceeding $6,600,000,000, an annual interest charge of $580,000,000 presented no difficulties. When their gross earnings declined in 1932 to about $3,200,000,000, an interest charge of $607,000,000 presented a problem that was simply insoluble without government aid, and its existence has had very bad and extensive effects upon railroad properties and general business. The trouble with a fixed charge in a period of depression is that it is fixed. Every other cost of the railways could be and has been greatly reduced, and the irreducibility of their large fixed charges without bankruptcy has, as the depression has lengthened and grown more severe, intensified the necessity for making unprecedented reductions in employment and purchases which have not only impaired the physical properties of the railways but have had bad and far reaching effects upon general business.

There is a conflict between the interests of the creditors of the railways, on the one hand, and their managements, stockholders, employees and the public, on the other hand, that is more apparent than real. It may appear contrary to the welfare of their bondholders to reduce the interest on their bonds and to accept preferred stock or other junior securities in place of some bonds that are now outstanding. The plain fact is, however, that not only cannot many railways now meet the interest and maturing principal of a large part of their bonds without loans from the government, but that they are likely not to be able to do so for some time, and that the more deeply they go into debt to the government the more difficult it will become for them to meet their accumulating obligations to both their private creditors and the government. The government should not be expected to go on much longer making loans to the railways which actually

are not being made to help them, but to help their creditors. A substantial revival of traffic and a reasonable reduction of wages would speedily make most railways able to earn their fixed charges, provided they were not quickly followed by substantial reductions of freight rates, but that would not change the fact that the fixed charges of many railways have been and are relatively too high even for years of mild depression.

Readjusting Railway Costs to Conditions

For the welfare of all concerned it is essential that there shall be adopted measures of readjustment which will enable the railways to again become a going industry which can pay all its costs and meet all its obligations directly or indirectly out of its own earnings. These measures should include reductions of wages and taxes; federal and state legislation which will enable the railways to compete on terms of equality with other carriers; and also voluntary readjustments of indebtedness which will reduce the fixed charges of many companies. Some of these readjustments of indebtedness cannot be made without losses to creditors; but they should be made, anyway. Some of them can be made without loss, and even with profit, to creditors, because, if past experience is any criterion, many railway companies, after reductions in their fixed charges by the exchange of bonds for preferred stock, for example, will be able to effect operating economies and increases in net earnings, which will make their stock worth as much or more as the bonds for which it is exchanged.

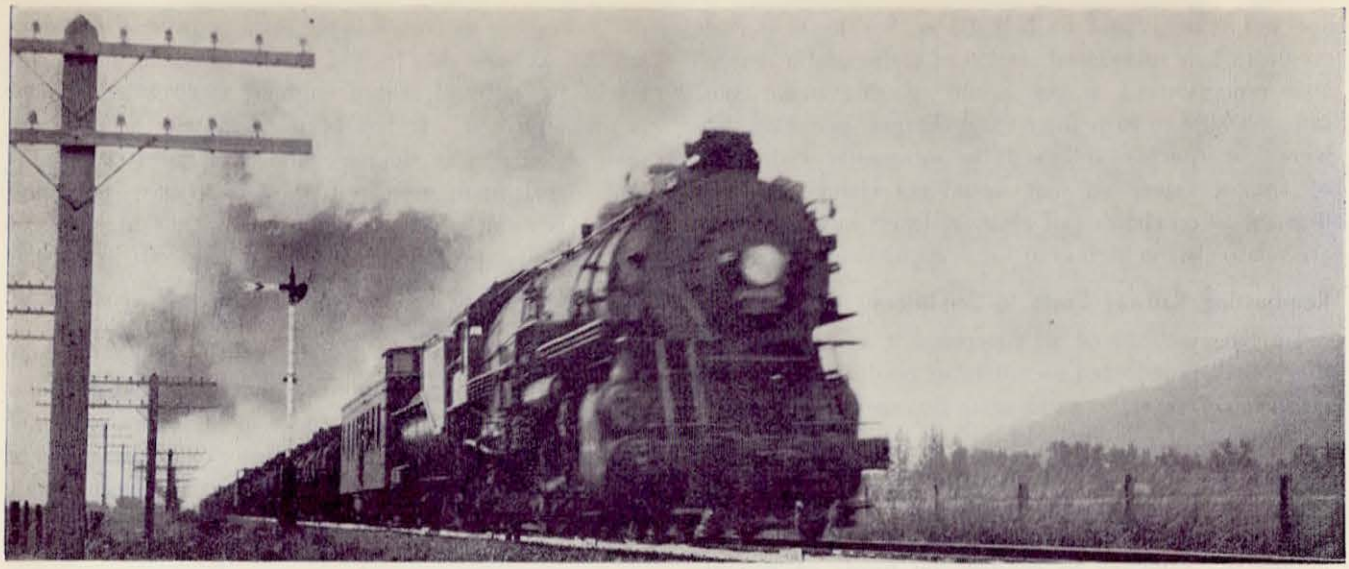
The depression has been caused, prolonged and deepened by the fact that so many persons would not face facts. The facts regarding developments in the railroad industry within recent years are only too plain and should now be squarely faced by all concerned. One fact which has been made only too plain is that the fixed charges of many railways are too large and should be substantially reduced.

Truck Delivery of Carload Freight

Store-door delivery of l.c.l. freight has advanced beyond the experimental stage sufficiently to indicate that its general adoption by railways throughout the country is merely a matter of time. The newest proposal challenging the attention of railroad operating and traffic officers is also concerned with store-door delivery, but this time with motor truck delivery of carload freight. Under prevailing conditions of operation, carload freight is delivered to consignees either at team tracks or, more generally, at the industrial tracks of consignees receiving larger quantities of freight in carload lots. Where the consignee must come to the railroad team tracks for his freight, there is no element of "store-door delivery" as the term is ordinarily understood. Where the freight is delivered to industrial tracks by railroad switch engines, store-door delivery is accomplished. It has been suggested that to give carload delivery to shippers who have industrial tracks and to refuse to give it to those who have not such tracks is to discriminate against one class of shippers and to give preference to the others. It has been suggested further that if store-door delivery is to be granted to one shipper, it should be granted to his neighbor, and, finally, that in the interest of faster deliveries and more economical deliveries, these should be accomplished by motor trucks in the case of carload as well as l.c.l. freight in all cases except those where daily deliveries amount to substantial numbers of carloads.

The motorization of terminal operations, the delivery of carload as well as l.c.l. freight by motor trucks, is a subject to which railway officers can well devote careful and open-minded attention. It is easy to see that the process of motorizing the terminal operations of the railways to the fullest possible extent might well revolutionize many railway practices in vogue today. The railroad yard on centrally located and therefore high-priced land, the downtown freight station which performs more of the functions of a storehouse than of a platform across which to pass freight quickly on its way from the consignor to the consignee, the switch engine making its daily rounds over congested rails to leave one car here and another there—all of them adding greatly to the cost of freight transportation—would scarcely be required to their present extent under a system of motorized deliveries within terminal areas for all except freight moving in multiple-car quantities. The proposal may appear radical at this time, but radical changes in the methods employed by the railways in handling freight may well be necessary if they are to meet the increasingly effective challenge of the motor truck as a carrier of freight from shipper to consignee. One road, the St. Louis Southwestern, is already making extensive experiments with truck delivery of carload freight. The results so far indicate that substantial savings in time in transit and similar savings in the cost of handling are being accomplished in this way. Railroad officers throughout the country will be well advised to watch closely this experiment in railroad operation.

The best transportation service which this country has ever enjoyed will be available when there is the fullest possible co-ordination of railway and other forms of transportation. Motorization of the terminal operations of railroads, as has been suggested, represents one form of co-ordination of railway and highway facilities. It may be the answer to many of the puzzling problems of meeting competition and of reducing costs of operation which the railways are now striving to solve.



A. R. A. 50-Car Air-Brake Test Train Passing Over an Automatic Track Trip at High Speed

Accomplishments in Railway Mechanical Research

Almost 2 1/3 million dollars has been spent by the railways on brake investigation alone in the last few years

SINCE American railroads are primarily users, and not manufacturers, of mechanical equipment and supplies of all kinds, much of the engineering research and experiment required in the development of these products is done by manufacturers, being subsequently paid for, in most cases, by the railroads. It is a fact, however, that the accomplishments of the railroads themselves, in the field of scientific research, as differentiated from routine testing, constitutes a record little known or appreciated by the general public and one of which the railroads may well be proud. In the investigation of power brakes alone, for example, large expenditures by air-brake manufacturers in their own test laboratories have been supplemented by $2,326,000 spent by the railroads from December, 1924, to date, in an effort to develop the characteristics of a freight brake best adapted to meet modern operating requirements.

Railway mechanical research comprises essentially that done by individual railroads and that done jointly by a large majority of steam railroads through their membership in the American Railway Association. This association serves not only as a clearing house to make the results of individual railroad investigations generally available, but, through its various divisions, conducts investigations of important specialized problems of the railroads as a whole, which, because of their nature, may best be solved through joint research. The carefully co-ordinated study, analysis and investigation of mechanical problems which lend themselves to centralized research is carried on in the A. R. A., Mechanical Division, by one or more of 23 committees, subcommittees and joint committees, comprising 197 railroad officers who are practical operating men, engineers and technical specialists. These railroad committees avail themselves of every possible outside assistance by working closely with 18 groups, listed in the table, of equipment manufacturers, technical associations, shippers and government bureaus.

Railway Progress Hinges on Co-operative Research

The notable achievements of the railroads in increased safety and efficiency of operation have been in the past, and will be in the future, effected to no small extent by the use of improved mechanical equipment and materials of all kinds, developed to maximum usefulness only through closely co-ordinated research on the part of manufacturers, individual railroads and railroads as a whole acting through the A. R. A. The records of the Mechanical Division constitute an impressive exhibit of railway research activities and accomplishments, from which the following few examples are selected and re-

Committees and Groups with which the A. R. A., Mechanical Division, Works in Co-operative Investigation and Research

The Technical Committee of the Coupler Manufacturers.
The Association of Manufacturers of Chilled Car Wheels.
Association of American Steel Manufacturers Technical Committee.
Association of Railway Electrical Engineers.
Committees of the American Petroleum Institute.
Committees of the American Railway Car Institute.
Committees of the Manufacturing Chemists Association.
Bureau of Explosives.
Bureau of Safety, Interstate Commerce Commission.
Bureau of Service, Interstate Commerce Commission.
American Standards Association.
American Society of Mechanical Engineers.
National Safety Council.
American Railway Engineering Association.
American Society for Testing Materials.
Various groups of shippers.
The several Weighing and Inspection Bureaus.
The various Divisions and Sections of the American Railway Association.

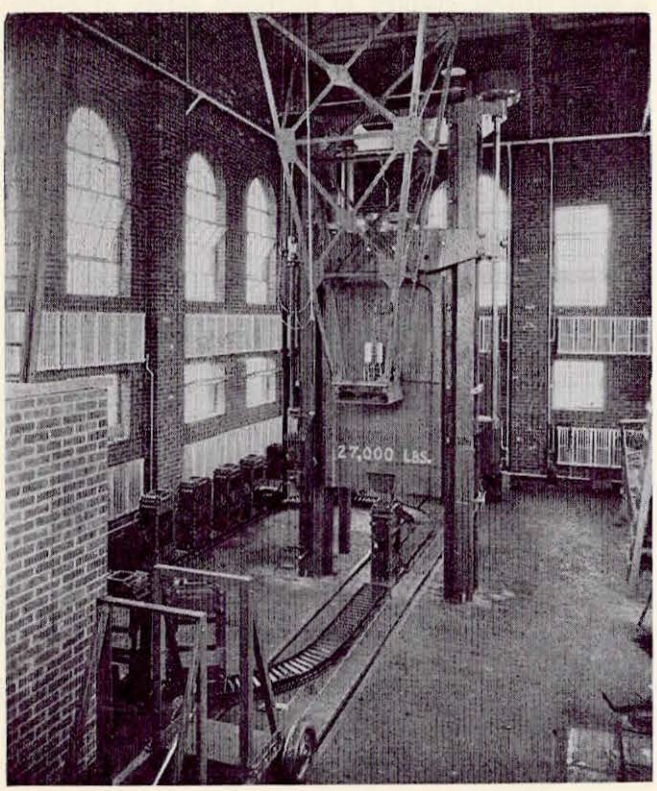
ferred to only as typical and not necessarily in the order of their importance.

Couplers

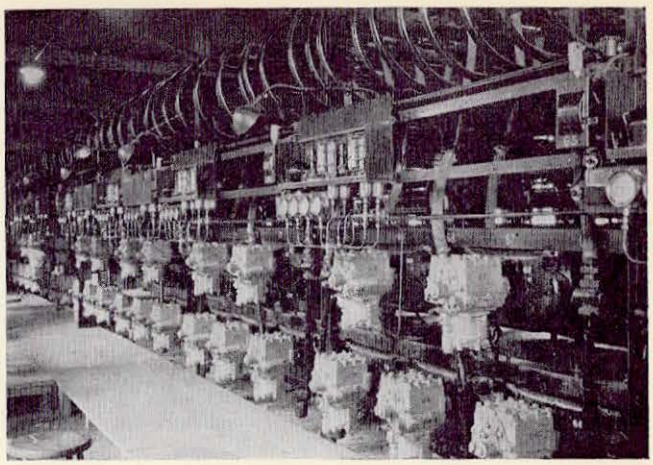
Probably no single item has contributed more to the free interchange of freight cars and the expeditious handling of commodity shipments than the automatic coupler, which has been the subject of continuous research and improvement since 1887 when the first automatic coupler was adopted as standard by the Master Car Builders' Association, subsequently merged with the Master Mechanics' Association to form the A. R. A., Mechanical Division. From a total of about 3,100 patents for car couplers, in existence in 1885, 20 were finally selected and subjected to elaborate tests in 1892 at the Watertown (Mass.) arsenal and at the Pennsylvania's testing laboratory at Altoona, Pa., in an effort to develop satisfactory coupler standards and limits.

In 1916 a single standard Type-D coupler design was adopted, with all of its parts standardized and interchangeable, this design being subjected to exhaustive static and dynamic tests, using the testing facilities of the Pennsylvania, the Baltimore & Ohio, the National Malleable & Steel Castings Co., the American Steel Foundries, the Baldwin Locomotive Works and the Pressed Steel Car Company to facilitate the work. Specifications for the improved Type-E coupler were adopted as recommended practice in 1930 and advanced to standard in 1931, all parts being kept interchangeable with the respective parts of the Type-D coupler.

When it appeared that there might be a demand on the part of the railroads for a coupler with a swivelling feature, several designs were developed, the manufacturers being prevailed upon to come to an agreement regarding one type of swivel-butt coupler. This action on the part of the manufacturers made it necessary to develop comparative data on the strength of the parts involved, and tests were made in the laboratories of the Buckeye Steel Castings Company and the National Malleable & Steel Castings Co. Swivel-butt designs for Type-D and Type-E couplers and swivel yokes were adopted as alternate standard in 1931.



Interior of A. R. A. Draft-Gear Test Laboratory at Purdue University—View Shows a Draft Gear Being Tested Under the 27,000-lb. Tup.



A. R. A. 100-Car Air-Brake Test Rack at Purdue University—Automatic Straight Air Equipment Installed Ready for Test

In all the work of coupler development, the manufacturers have co-operated fully through a technical committee composed of engineers, representing all of the manufacturers. A large portion of the expense of this co-operative research has been borne by the manufacturers who maintain a joint research laboratory at Cleveland, Ohio.

Wheels

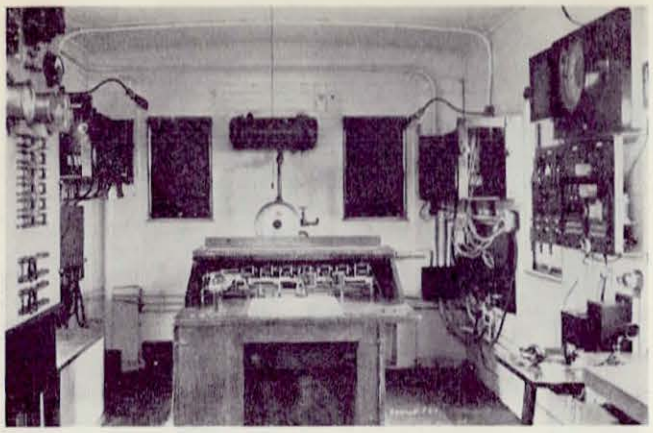
The subject of wheels for cars and locomotives has been a matter of co-operative research for many years under the direction of the Committee on Wheels, the manufacturers co-operating to the fullest extent in this research. All necessary condemning and remount limits for wheels and axles have been adopted and enforced through the rules of the former Master Car Builders' Association and the present Mechanical Division. These limits, developed by research and experience, have always provided a liberal factor of safety. They are reviewed annually to keep pace with the different designs and materials made available from time to time.

The manufacturers of cast-iron wheels maintain a central research laboratory in Chicago where a great deal of the research in connection with this type of wheel has been carried on. To assist in this work, the cast-iron-wheel manufacturers have organized an association with a paid personnel of engineers, inspectors, etc., known as the Association of Manufacturers of Chilled Car Wheels.

Manufacturers of wrought-steel wheels also have organized a technical committee to co-operate with the Committee on Wheels of the Mechanical Division in connection with designs and specifications for this type of wheel. The laboratories of the steel wheel manufacturers are utilized in this research work, as well as the laboratories of the railroads.

The manufacturer of cast-steel wheels also has a research laboratory and has co-operated to the fullest extent in the research involved in the question of wheels. Where service tests have been necessary, arrangements have been made through the Committee on Wheels for service trials and the keeping of service records on selected roads so that complete information can be compiled and studied.

The largest portion of the expense in connection with this research work has likewise been borne by the wheel manufacturers. Individual railroads are co-operating



Dynamometer Car Chronograph and Trainagraph Instruments Used in Recording Time, Speed, Car Travel, Buff, Drawbar Pull and Detailed Air-Brake Operating Conditions

with the committee in this research, which is going on continually.

Air-Brake and Draft-Gear Research Centralized

Safe and efficient train operation are absolutely dependent upon adequate braking equipment and the subject of air brakes has been one of continuous individual railroad and centralized research for many years. The American Railway Association has owned its own air-brake testing laboratory since 1893. This laboratory was located in Altoona, Pa., until 1898, when it was removed to Purdue University, Lafayette, Ind., being modernized from time to time as conditions required.

The air-brake research of the Mechanical Division is under the general direction of the Committee on Safety Appliances, assisted by the Committee on Brakes and Brake Equipment. In 1923, a director of research was employed to conduct a definite program of air-brake research to develop what, if any, improvement was necessary in existing power brakes and appliances for operating power brake systems. This program of research involved several years of laboratory and road tests of air-brake equipment, the tests being completed over a year ago, at a cost mentioned previously in this article. The voluminous report of the director of research, covering these tests, is now being studied and analyzed, but no definite conclusions or recommendations have yet been made.

One specific result of the A. R. A. power brake investigation has been the development of an improved Type-AB freight brake equipment which is still experimental but scheduled for extensive test under actual service conditions during the coming months. This brake is designed to afford important improvements over the present standard air brake in application and release functions and also to effect economies in maintenance cost.

The necessary qualifications and specifications for draft gears have been intensively studied for many years under the direction of the Committee on Couplers and Draft Gears. In this work, testing facilities have been used as follows: Pennsylvania laboratory, Altoona, Pa.; Baltimore & Ohio laboratory, Baltimore, Md.; laboratory at the Watertown arsenal, Watertown, Mass.; and the laboratories of the various draft-gear manufacturers. Within the past few years, the association has built and equipped its own draft-gear laboratory at Purdue University.

As a result of this co-operative research, the A. R. A., Mechanical Division, has adopted purchase specifications for approved standard draft gears for freight service. These specifications provide that draft gears shall be tested by the association at its Purdue laboratory to determine if they meet the specifications. When they do, certificates of approval are granted to the manufacturers. The Interchange Rules have been revised to provide that new cars built on or after January 1, 1934, must be equipped with approved draft gears having certificates of approval of the association and that new draft gears for replacement must comply with the specifications where it is practicable to use a specification gear. These approval tests are now proceeding at the association's laboratory.

Much of the expense of the co-operative research in draft gears has been borne by the draft-gear manufacturers, but the A. R. A., itself, has expended $55,834 in the building of the laboratory and purchase of testing equipment, in addition to which it has spent about $72,000 for research work conducted in the laboratory to date. The results of this research are not yet known and will always be difficult to evaluate. They will undoubtedly include large reductions in railway claim payments and equipment maintenance expense.

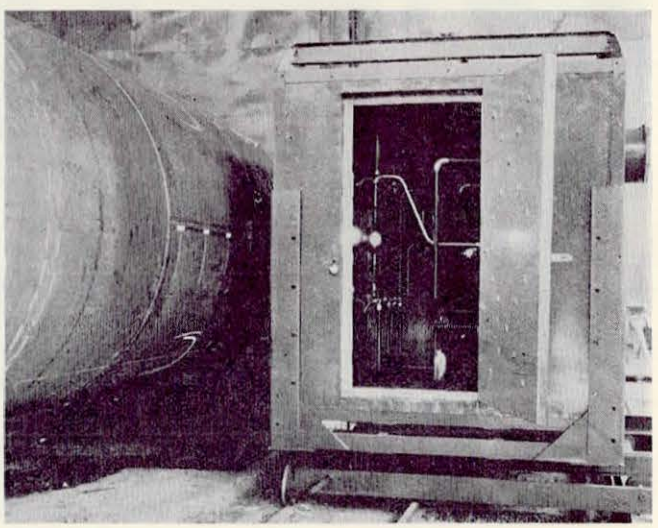
Cast-Steel Side Frames

An extensive research program in connection with specifications for cast-steel side frames for freight-car trucks was conducted under the direction of the Committee on Car Construction during the years 1925, 1926 and 1927. In connection with these tests, the dynamic testing machine at the laboratory of The T. H. Symington Company at Baltimore, Md., the dynamic testing machine of the American Steel Foundries at Granite City, Ill., and the 600,000-lb. tensile testing machine of the B. & O. at Baltimore, Md., were used.

A considerable portion of the expense of these tests was borne by the manufacturers. The results may be summarized as the development of improved types of cast-steel truck side frames which have contributed in a most striking manner to increased safety of railway operation and reduced maintenance expense.

Tank Cars and Appurtenances Tested

The Mechanical Division maintains a laboratory at Purdue University for the testing of tank-car devices and appurtenances. The tank-car specifications of the American Railway Association and the container specifications of the Interstate Commerce Commission pro-



General Electric X-Ray Equipment Being Used in the Examination of Electrically Welded Car-Tank Seams

vide that only approved devices and appurtenances may be used on tank cars. All devices submitted are subjected to tests in this laboratory.

In addition, during the past year, the Committee on Tank Cars, with the co-operation of the builders of car tanks, the General American Tank Car Corporation, and the Chicago, Rock Island & Pacific, conducted, in co-operation with the Bureau of Service, an elaborate series of tests of car tanks having both forged and electric fusion-welded seams. Destruction tests of sample tanks were conducted at the plant of the General American Tank Car Corporation, East Chicago, Ind., and the laboratory tests of specimens taken from the welds of the tanks were conducted at the laboratory of the Rock Island railroad at Chicago, Ill.

Automatic Train-Line Connectors

The A. R. A., Mechanical Division, has established a laboratory at Purdue University to investigate devices designed automatically to couple air-brake, air signal and steam-heat lines between cars. A director of research and a paid personnel are conducting this investigation under the direction of a Joint Committee on Automatic Train-Line Connectors representing the Mechanical and Operating divisions of the A. R. A. Following these laboratory tests, it is proposed to make road service tests of those devices which possess sufficient merit.

This investigation is being conducted at the expense of the American Railway Association, all of the devices for test being purchased by the association.

Brake Beams and Brake Shoes

The Committee on Brakes and Brake Equipment, in co-operation with a committee representing the brake-beam manufacturers, is investigating the question of brake beams for freight cars with a view of developing a completely standardized brake beam in all its details. Many of the brake-beam details are already standardized, including certain specification limitations. It is expected that this project will be completed within the next year.

The specifications for brake shoes, which must be met by all brake shoes on interchange freight cars used in the United States, Canada and Mexico, were developed through an intensive program of research. This research was conducted at Purdue University, special testing machines being developed and built by the railroads for that purpose. All new types of brake shoes offered for use by the railroads must be tested on this machine and approved before their general use is authorized. This investigation is in charge of the Committee on Brakes and Brake Equipment.

Intensive Car and Locomotive Research

The Committee on Car Construction, in co-operation with a committee of engineers, representing the American Railway Car Institute, is engaged in the preparation of designs for standard cars, including the intensive study of existing types of cars, with a view to designing new types of minimum light weight consistent with adequate strength to meet service conditions.

This committee, during the past year, designed and presented to the railroads for approval a design of steel-sheathed wood-lined box car, which weighs from 3,000 to 4,000 lb. less than existing box cars of similar type and capacity.

In co-operation with the manufacturers, the railroads have conducted extensive laboratory and service tests of locomotives and locomotive appliances for many years in an endeavor to perfect those types of equipment best adapted to meet various operating requirements. Comprehensive, scientific tests have been made at railroad and university-owned locomotive testing plants, and, in road service, dynamometer cars, operated by competent engineers and test crews, have been largely used on individual railroads to develop the facts regarding individual locomotive performance.

The value of these tests over a period of years is best indicated by the improvement in locomotive performance. In the past two decades, the average tractive force of steam locomotives has increased roughly 62 per cent. Trainload increased 14 per cent in the single decade ending with 1929. In the past 10 years, average freight-train speed has increased about 44 per cent and ton-miles per train-hour, 48 per cent. In the same period, unit fuel consumption, on a 1,000-gross-ton-mile basis, has decreased 30 per cent. While not all of this improvement may be credited to more efficient motive power, improved modern locomotives have been one of the most important factors in establishing these records.

During the past three years, the Committee on Locomotive Construction, in co-operation with the Committee on Specifications for Materials and the manufacturers, has developed detailed designs and specifications for various important fittings for high-pressure locomotives.

Other committees of the Mechanical Division are carrying on co-operative research by arranging for limited road service tests on selected railroads and utilizing the laboratories of the individual railroads and the manufacturers. Among the problems being handled in this way are the following: Tests of various materials for use in car and locomotive construction; tests of detailed parts of cars, locomotives and trucks; tests of flexible steam-heat hose recently developed by the Rubber Manufacturers' Association; tests of various loading devices and loading methods.

The preceding necessarily limited outline of railway research activities is confined solely to those in the mechanical field and yet constitutes an effective refutation of the charge that railroads are backward in promoting individual railroad research, as well as joint investigations with other roads and with the manufacturers.

Debate Rail Bill in Canada

CANADA'S parliamentary battle over the best means to be adopted to save the railway situation has entered its final stage with presentation of the bill to the House of Commons by Hon. Robert J. Manion, Minister of Railways, after the measure had been passed by the Senate. The bill provides for control of the Canadian National by three trustees instead of a board of directors and close co-operation to reduce competition between the companies, which may be made compulsory by the decisions of an arbitral tribunal to be set up to require co-operation. In the Senate there was open and vigorous opposition to the bill by those who are opposed to public ownership, and before the Senate Railway Committee President E. W. Beatty of the Canadian Pacific strongly opposed the measure because of its provision for the arbitral tribunal, with broad powers to enforce co-operation.

In the first week of the debate in the House the Liberals criticized the bill from another angle, the Liberal leader, Rt. Hon. Mackenzie King, declaring that his party was unalterably opposed to amalgamation of the Canadian National with the Canadian Pacific. He argued that one provision of the bill which would give excessive powers to the proposed board of trustees,

(which is to replace the board of directors of the C. N. R.), might even pave the way for amalgamation since the trustees, he contended, might do almost anything with the Canadian National without reference either to Parliament or to the Government.

Premier Bennett's reply to this argument was that there was nothing in the legislation that would make possible, either directly or indirectly, amalgamation of the two roads, that the people of Canada were not ready for amalgamation, that before such a step would be attempted there would be a plebiscite submitted to the people at a general election. In the meantime, to allay the apprehensions of those fearful of amalgamation the Prime Minister said that a section would be inserted in the bill securing the country against amalgamation.

To put the Liberal position properly before the House Mr. King late last week moved as an amendment to the motion for second reading of the bill a clause calling for a declaration from the House against amalgamation and also against any subtraction from the powers of Parliament or of the Government in connection with the control of the Canadian National. He declared that

Rt. Hon. R. B. Bennett, Prime Minister

Rt. Hon. W. L. Mackenzie King, Liberal Leader

Hon. Dr. R. J. Manion, Minister of Railways

Hon. W. D. Euler, Public Qwnership Advocate

if the Government would accept this amendment the second reading of the bill could be passed unanimously, but if it was rejected by the Ministry then he would be obliged to vote against second reading in the absence of any clear guarantee against amalgamation.

Premier Bennett promptly met this challenge first by declaring that the amendment was out of order and that it could not be considered in the manner suggested as it was the negation of the motion for second reading. He met the Liberals nearly half way, however, by promising to insert in the bill the section already referred to.

During last week in addition to the speeches by the two party leaders there was a clear presentation of the main purposes of the bill by Dr. Manion, Minister of Railways, and a strong case in favor of public ownership and against amalgamation by Hon. William D. Euler, a former Liberal Cabinet Minister and one of the few outspoken public ownership advocates in Parliament. Hon. James Malcolm, also a former Liberal Cabinet Minister, called attention to waterway and highway competition, free of tolls, and the difficulties they present to the railways which must provide their own roadways.

Dr. Manion, in moving second reading of the bill, stressed the fact that the measure "is a co-operative bill," that it had for its central purpose the co-operation of the two railways to effect economies. "There is nothing in it," said the Minister of Railways, "to cause anyone to fear that it may lead to the amalgamation of the two great railways, because the whole spirit and trend of the bill points to co-operation, not amalgamation." The railway problem was the greatest confronting the Dominion, not excepting unemployment. The C. N. R. interest bill on the debt owing to the public in 1932 was $58,000,000, as compared with the Canadian Pacific's fixed charges of $22,000,000. In addition there was another interest bill piling up on the books of the company and not shown in the public accounts of the federal government, amounting to $35,000,000 annually.

Premier Bennett said, in part:

> The high court of parliament has been called upon to determine how many men shall constitute the trustees for this system, to bring about again equilibrium between income and expenditures, and restore this road to a position where it will earn its way. The high court of parliament is now asked to accept or reject the advice which has been given by those who went out and studied this problem more carefully than you or I can study it—and their conclusion is that three is the number which should be appointed. I share that view. The directors disappear, not because the commission wanted to get rid of directors, per se; they disappear because of the financial position of this enterprise. They disappear because in a court of law, under normal conditions, they would thus disappear.
>
> The property is not the property of the people, except to the extent to which the people own the securities which are in default. No interest has been paid upon it, and therefore it is fair to say that the Canadian people, as the holders of securities, have an interest in the enterprise. But this enterprise belongs to the investors. We are now dealing with very simple matters—securities, property in default, and security owners having a right to enforce their claims unless we, as guarantors, exercise our position and make payments.
>
> There is no sinister design behind this measure to accomplish the amalgamation of these systems, when this parliament is opposed to that being done. The people of this country own not the road but the equity of redemption. And so long as the government of Canada is Father Christmas and pays under the guarantee, just so long, there being no foreclosure, that equity of redemption has a right to express its views as to what shall be done. And it can only in my judgment be done in the manner I have indicated, by affording to every citizen who, in the end, owns the equity of redemption, an opportunity to express an opinion for or against amalgamation.

On Friday of last week Mr. Mackenzie King's amendment to postpone second reading was ruled out of order by the Speaker of the House. Mr. King appealed from the ruling and the Speaker was sustained by a vote of 88 to 35, all the Progressive and Labor members voting with the Conservatives and against the Liberals. Debate then continued on the main motion for second reading.

"I know," said Mr. Euler in the course of his remarks, "that at the moment there is no use arguing in favor of amalgamation, because at this time I do not believe the people of Canada desire it. I do say, however, that if amalgamation does come the people of Canada will not stand for private monopoly of the railway business. If we have amalgamation it must be publicly owned."

Sir Henry W. Thornton Dies

Former head of Canadian National, an American-born British Knight, had brilliant and unusual career

SIR HENRY WORTH THORNTON, K. B. E., former chairman and president of the Canadian National, died in a New York hospital on March 14 from pneumonia which set in following an operation, thus bringing to a close, at the age of 61, a career as spectacular, probably, as was ever vouchsafed to a railroad man. Born at Logansport, Ind., Sir Henry learned railroading on the Pennsylvania, with which system he rose to the general superintendency of the Long Island Railroad. From that position he was called to the general managership of the Great Eastern of England—an unprecedented step: Never before had a British railway sought beyond the borders of the realm for a chief executive. Following a brilliant war record, during which he rose to a major generalcy in the British army, Sir Henry was made a Knight of the British Empire in 1919. In 1922 he was chosen by the Canadian government to amalgamate and head its various railway properties. This position he relinquished last year under criticism from a government of different political faith from that which had called him to Canada and which was in power most of the time that he managed the affairs of the Canadian National.

Sir Henry Worth Thornton, K. B. E.

A commanding figure of a man—in his youth he was a famous college athlete—Sir Henry's outstanding characteristic was his outspoken friendliness and his ability to secure the co-operation of those with whom he was associated. His relations with leaders of organized labor, both in Great Britain and in North America, were markedly friendly and he was scheduled late this month to attend, as guest of honor, a dinner planned by leaders of organized labor at New York, at which time an illuminated testimonial was to have been presented to him.

Henry Worth Thornton was born on November 6, 1871, at Logansport, Ind. He attended St. Paul's School, Concord, N. H., and was graduated in civil engineering from the University of Pennsylvania in 1894. Shortly thereafter he began his railroad career with the Pennsylvania as a draftsman in the chief engineer's office. Subsequently he served as an assistant engineer of construction, topographer and division engineer. Later promoted to superintendent, he served in this capacity on several divisions and in 1911 was advanced to the post of general superintendent of the Long Island. In 1914 Lord Claude Hamilton, chairman of the Great Eastern Railway, astounded the directors of that property by announcing to them that he had engaged an American, Thornton, to become general manager of that property. The line having a vast suburban traffic, electrification was contemplated, and Sir Henry's experience on the Long Island had prepared him for the task.

The action of Lord Hamilton was severely criticised in many quarters, but opposition disappeared following Sir Henry's arrival and the evidence he quickly gave of a determination to deal fairly with the existing organization of the railway. From 1914 to 1916, he was a member of the Committee of General Managers which controlled the British Railways during the war. In 1916-17, he was deputy director of inland water transportation, with the rank of colonel in the Royal Engineers. In 1917 he was appointed assistant director general of railway movements at Paris, representing the director and army council in negotiations with the French, Italian and American governments. In 1917-18 he was deputy director general of railway movements with the rank of brigadier general. In 1918-19 he was inspector general of transportation, being advanced to major general. In 1919 he was naturalized as a British subject and was gazetted Knight Commander of the Order of the British Empire. He had conferred upon him also the companionship of the Legion of Honor (France), the Order of Leopold (Belgium) and the Distinguished Service Medal (U. S. A.). Returning actively to the Great Eastern following this, Sir Henry served on several occasions on the National Wages Board in arbitration proceedings between the railways and their organized employees.

Assuming the presidency of the Canadian National in 1922, Sir Henry was faced with the task of welding together several separate railway organizations—one of the most difficult of all managerial problems. That he accomplished this in record time and with a minimum of discord, few, even among his critics, would deny. And he did have critics. They became increasingly vocal as the depression became deeper and deeper and as the Canadian people became more and more alarmed at the deficits of the Canadian National, the top-heavy capital structure of which still persists in spite of many efforts which have been made to correct it. The property was in no sense a first class railroad when he took over its management. Most of its passenger equipment was of wooden construction at a time when such equipment was rapidly approaching the museum status on most railroads. In many other respects as well, the property lacked the

characteristics of a first class system in which the owners and the staff could take pride. Sir Henry set out to correct this deficiency and he did so thoroughly. The expenditures made to this end, which were demanded by dominant public opinion when they were made, were the source of the criticism which arose with the depression when the public mind turned to economy. Sir Henry gave the Canadian people a splendid railroad plant and under his leadership the net revenues of the system rose from about 6 million in 1922 to almost 60 millions in 1928, the year of greatest traffic in Canada. These maximum earnings, however, were not sufficient to pay interest on all the securities of the property which are owned by the Canadian government, nor is it likely that the road ever can earn enough to pay interest on the capital structure as it is now constituted.

Commenting upon Sir Henry's death, General W. W. Atterbury, president of the Pennsylvania, a friend of many years' standing, said:

"I learned with great regret of the death of Sir Henry W. Thornton. His career was unusually varied. He served with marked ability, skill and success in important posts on railroad systems in three countries—his native land, England and Canada. His achievements in directing the transport service of the British Army in France, during the World War, won for him the high honors and decorations of Great Britain and of all the allied nations. His work was particularly valuable because his broad knowledge of American methods made possible almost perfect co-operation in the movements of the British troops and our own Expeditionary Forces.

"Sir Henry's work in Canada was of the highest character and demonstrated his remarkable administrative and organizing capacity. The value of his accomplishments to the people and the Government of the Dominion will, I believe, grow in appreciation as time goes on. His task there was a particularly difficult one. Fortune had placed under the ownership of the Canadian public a group of disjointed and impoverished rail lines, largely built to be competitive with one another. Out of this unpromising material Sir Henry welded together one of the world's great railroad systems, the Canadian National, and in so doing performed a high service of permanent value.

"His death, at less than sixty-two, is untimely, and there can be little doubt that if his life and health had been spared he would have been called into new fields of activity and usefulness."

Net Deficit in 1932 Was $153,308,487

WASHINGTON, D. C.

THE 162 Class I railways of the United States last year had a net deficit of $153,308,487 after payment of fixed charges, according to the Interstate Commerce Commission's monthly compilation of selected income and balance-sheet items. This compares with a net income of $116,362,840 for the same roads for 1931. For the month of December there was a net income of $1,731,672, as compared with $11,446,664 in December, 1931. The net railway operating income of these roads for the year was $336,112,509 and other income amounted to $210,143,966, while interest and other deductions amounted to $699,564,962. One hundred and sixteen of the Class I roads, representing approximately 75 per cent of the mileage, had net deficits for the year after payment of fixed charges, while 57 of them had operating deficits.

An analysis of the reports included as an exhibit with the answer filed by the Association of Railway Executives to the petition of various organizations asking the Interstate Commerce Commission to institute proceedings looking to a general rate reduction, showed that the aggregate deficit for the 116 roads that had net deficits for the year amounted to $265,470,906 and that 127 roads would have had an aggregate deficit of $308,346,757 were it not for the emergency revenue derived from the freight rate surcharge. According to this compilation 46 roads, representing 25 per cent of the mileage, therefore earned a net income of approximately $112,000,000. The roads of the Pocahontas region had a net income of $42,975,871 and those of the Central Western region a net income of $9,599,669, while all other regions showed deficits.

Of the individual roads, according to the commission compilation, the largest net income was that of the Union Pacific Railroad, $26,177,262. The Chesapeake & Ohio had a net income of $23,527,755, the Norfolk & Western a net of $16,984,376, and the Pennsylvania Railroad a

Selected Income and Balance-Sheet Items of Class I Steam Railways in the United States

Compiled from 160 reports (Form IBS) representing 165 steam railways, including 17 switching and terminal companies

TOTALS FOR THE UNITED STATES (ALL REGIONS)†

For the month of December 1932	For the month of December 1931	Income Items	For the twelve months of 1932	For the twelve months of 1931
$33,005,612	$27,838,209	1. Net railway operating income	$336,112,509	$540,076,437
32,026,118	45,776,469	2. Other income	210,143,966	270,121,482
65,031,730	73,614,678	3. Total income	546,256,475	810,197,919
11,646,557	11,397,214	4. Rent for leased roads	133,448,763	132,745,510
46,910,511	45,909,322	5. Interest deductions	537,964,072	531,854,457
4,742,990	4,861,478	6. Other deductions	28,152,127	29,235,873
63,300,058	62,168,014	7. Total deductions	699,564,962	693,835,840
1,731,672	11,446,664	8. Net income	d 153,308,487	116,362,079
		9. Dividend declarations (from income and surplus):		
10,898,126	32,498,957	9-01. On common stock	76,560,281	277,583,603
3,552,810	9,037,560	9-02. On preferred stock	19,031,610	54,133,406

BALANCE-SHEET ITEMS

	Balance at end of December 1932	Balance at end of December 1931
Selected Asset Items		
10. Investments in stocks, bonds, etc., other than those of affiliated companies (Total, Account 707)	$766,991,645	$815,611,288
11. Cash	312,300,183	334,050,054
12. Demand loans and deposits	35,536,673	55,130,495
13. Time drafts and deposits	39,682,214	41,761,930
14. Special deposits	45,773,783	48,719,821
15. Loans and bills receivable	11,005,613	14,093,533
16. Traffic and car-service balances receivable	53,281,987	60,033,661
17. Net balance receivable from agents and conductors	35,462,661	39,626,445
18. Miscellaneous accounts receivable	140,893,846	168,339,245
19. Materials and supplies	319,125,359	377,334,638
20. Interest and dividends receivable	36,083,891	38,869,235
21. Rents receivable	1,963,131	1,803,770
22. Other current assets	9,759,646	14,838,202
23. Total current assets (Items 11 to 22)	1,040,868,987	1,194,601,029
Selected Liability Items		
24. Funded debt maturing within six months*	241,603,127	107,985,066
25. Loans and bills payable	292,184,310	242,505,966
26. Traffic and car-service balances payable	66,939,450	76,530,444
27. Audited accounts and wages payable	204,500,825	250,150,714
28. Miscellaneous accounts payable	64,747,276	57,912,232
29. Interest matured unpaid	201,372,639	174,063,734
30. Dividends matured unpaid	13,073,951	18,012,852
31. Funded debt matured unpaid	50,101,394	49,248,364
32. Unmatured dividends declared	12,080,217	31,151,436
33. Unmatured interest accrued	96,766,984	96,633,365
34. Unmatured rents accrued	18,614,466	20,476,184
35. Other current liabilities	16,891,852	23,094,778
36. Total current liabilities (Items 25 to 35)	1,037,273,364	1,039,780,069

† Complete data for the following Class I railways not available for inclusion in these totals: Canadian National Lines in New England, Canadian Pacific Lines in Maine, and Canadian Pacific Lines in Vermont.

* Includes payments which will become due on account of principal of long-term debt (other than that in Account 764, Funded debt matured unpaid) within six months after close of month of report.

d Deficit.

net of $13,573,536. The largest net deficit was that of the Chicago, Milwaukee, St. Paul & Pacific, $23,269,678, while that of the New York Central Railroad was $18,256,400 and that of the Great Northern was $13,405,439.

The accompanying tables give the commission's compilation of the consolidated income and balance-sheet items and the net income for 1932 and 1931 by regions and by individual roads.

Net Income by Regions and Districts, Class I Steam Railways, Calendar Years 1932 and 1931

Region and Railway		Net Income 1932		1931
Eastern District:				
New England Region	d	$474,277		$11,943,575
Great Lakes Region	d	47,953,925	d	5,532,622
Central Eastern Region	d	87,214		26,547,325
Total, Eastern District	d	48,515,416		32,958,278
Southern District:				
Pocahontas Region		42,975,871		52,217,045
Southern Region	d	48,644,520	d	22,562,098
Total, Southern District	d	5,668,649		29,654,947
Western District:				
Northwestern Region	d	76,463,988	d	20,034,672
Central Western Region		9,599,669		71,215,785
Southwestern Region	d	32,260,103		2,567,741
Total, Western District	d	99,124,422		53,748,854
United States	d	153,308,487		116,362,079
Akron, Canton & Youngstown Ry	d	60,125	d	26,060
Alton & Southern R.R. *b*		222,116		209,698
Atchison, Topeka & Santa Fe Ry. *a*		7,545,008		23,101,691
Atlantic Coast Line System:				
Atlanta & West Point R. R	d	296,668	d	119,619
Atlanta, Birmingham & Coast R. R	d	813,514	d	906,707
Atlantic Coast Line R. R	d	6,685,229		2,020,858
Charleston & Western Carolina Ry	d	100,549		76,883
Clinchfield R. R		.....	d	1,007,221
Georgia R. R.—Lessee Organization	d	456,125	d	147,559
Louisville & Nashville R. R	d	2,108,875		1,039,946
Nashville, Chattanooga & St. Louis Ry	d	434,185	d	419,425
Western Ry. of Alabama	d	172,656	d	25,966
Baltimore & Ohio System:				
Alton R. R	d	1,259,705	d	2,856,214
Baltimore & Ohio R. R	d	6,334,978		3,427,662
Baltimore & Ohio Chicago Terminal R. R.		.....		.....
Staten Island Rapid Transit Ry		.....		.....
Bangor & Aroostook R. R		701,493		623,133
Belt Ry. of Chicago *b*	d	238,175	d	301,612
Bessemer & Lake Erie R. R	d	1,490,648		962,363
Boston & Maine R. R		800,660		3,377,279
Brooklyn Eastern District Terminal	d	142,300		547
Burlington-Rock Island R.R	d	855,735	d	1,203,063
Burlington Route:				
Chicago, Burlington & Quincy R. R		1,502,816		13,319,735
Colorado & Southern Ry	d	1,269,824		1,323,828
Fort Worth & Denver City Ry		649,931		1,242,731
Cambria & Indiana R. R		819,128		867,946
Canadian National System:				
Canadian National Lines in New England *b*	d	1,311,023	d	1,719,102
Central Vermont Ry	d	944,053	d	466,846
Duluth, Winnipeg & Pacific Ry	d	508,394	d	844,636
Grand Trunk Western R. R	d	5,404,179	d	4,161,298
Canadian Pacific System:				
Canadian Pacific Lines in Maine *b*		.....	d	44,452
Canadian Pacific Lines in Vermont *b*		.....		.....
Duluth, South Shore & Atlantic Ry	d	1,493,525	d	1,075,233
Minneapolis, St. Paul & Sault Ste. Marie Ry.	d	5,516,464	d	3,991,881
Spokane International Ry	d	392,114	d	257,975
Chesapeake & Ohio Ry		23,527,755		26,696,484
Chicago & Eastern Illinois Ry	d	3,411,419	d	3,641,118
Chicago & Illinois Midland Ry	d	434,578	d	116,755
Chicago & North Western System:				
Chicago & North Western Ry	d	11,216,820	d	6,034,125
Chicago, St. Paul, Minneapolis & Omaha Ry.	d	2,864,234	d	2,741,441
Chicago Great Western R. R	d	$1,346,905		$900,885
Chicago, Indianapolis & Louisville Ry	d	1,594,813	d	1,261,601
Chicago, Milwaukee, St. Paul & Pacific R. R.	d	23,269,678	d	13,812,759
Columbus & Greenville Ry	d	85,659		83,431
Conemaugh & Black Lick R. R	d	236,000	d	177,615
Delaware & Hudson R. R	d	4,477,591		8,788
Delaware, Lackawanna & Western R. R.	d	2,542,447		1,090,690
Denver & Rio Grande Western R. R	d	2,584,210	d	225,652
Denver & Salt Lake Ry		3,946		25,404
Detroit & Mackinac Ry	d	16,191		64,858
Detroit & Toledo Shore Line R. R		271,319		406,562
Detroit Terminal R. R	d	44,304		150
Detroit, Toledo & Ironton R. R	d	299,498	d	222,308
Duluth, Missabe & Northern Ry	d	2,956,212		1,237,031
Elgin, Joliet & Eastern Ry	d	2,441,907	d	1,625,905
Erie System:				
Chicago & Erie R. R		.....		.....
Erie R. R	d	3,142,997	d	901,093
New Jersey & New York R. R	d	309,128	d	258,838
New York, Susquehanna & Western R. R.	d	242,476	d	298,948
Florida East Coast Ry	d	3,316,630	d	2,395,046
Fort Smith & Western Ry	d	167,942	d	210,953
Frisco Lines:				
Fort Worth & Rio Grande Ry	d	403,567	d	359,993
St. Louis-San Francisco Ry	d	8,980,117	d	2,472,064
St. Louis, San Francisco & Texas Ry	d	613,783	d	448,504
Galveston Wharf Co		$196,526		$410,492
Georgia & Florida R. R	d	774,512	d	661,331
Great Northern Ry	d	13,405,439		5,325,907
Green Bay & Western R. R		112,277		122,784
Gulf, Mobile & Northern System:				
Gulf, Mobile & Northern R. R	d	542,694	d	227,070
New Orleans Great Northern R. R	d	373,154	d	22,564
Illinois Central System:				
Central of Georgia Ry	d	3,341,676	d	591,737
Gulf & Ship Island R. R	d	356,433	d	432,690
Illinois Central R. R	d	1,160,689	d	1,478,568
Yazoo & Mississippi Valley R. R	d	2,385,885	d	2,103,544
Illinois Terminal Co	d	679,956		399,982
Indiana Harbor Belt R. R		1,053,843		1,068,664
Kansas City Southern System:				
Kansas City Southern Ry	d	1,380,761		376,297
Texarkana & Fort Smith Ry		.....		.....
Kansas, Oklahoma & Gulf Ry		266,120		642,783
Lake Superior & Ishpeming R. R	d	286,852		642,783
Lake Terminal R. R		70,945		78,878
Lehigh & Hudson River Ry		181,593		254,378
Lehigh & New England R. R		432,041		510,921
Lehigh Valley R. R	d	3,933,043	d	2,261,045
Louisiana & Arkansas Ry		27,525		728,995
Louisiana, Arkansas & Texas Ry	d	102,995	d	150,598
Maine Central R. R	d	416,125	d	63,386
Midland Valley R. R		26,925		214,535
Minneapolis & St. Louis R. R	d	3,410,486	d	2,963,231
Mississippi Central R. R	d	178,302		25,815
Missouri & North Arkansas Ry	d	382,846	d	370,264
Missouri-Kansas-Texas Lines	d	542,705		628,282
Missouri Pacific System:				
Beaumont, Sour Lake & Western Ry	d	327,250	d	236,097
International-Great Northern R. R	d	2,427,332	d	390,083
Missouri-Illinois R. R	d	131,139		8,407
Missouri Pacific R. R	d	10,260,861		1,395,754
New Orleans, Texas & Mexico Ry	d	956,189		3,548,564
St. Louis, Brownsville & Mexico Ry		313,183		397,879
San Antonio, Uvalde & Gulf R. R	d	327,045	d	362,810
Texas & Pacific Ry		92,710		2,041,858
Monongahela Ry		311,629		432,905
Monongahela Connecting R. R	d	300,868	d	136,982
Montour R. R		673,451		876,983
Nevada Northern Ry	d	$5,636	d	$218,970
New Haven System:				
New York, New Haven & Hartford R. R.	d	393,047		9,179,869
New York, Ontario & Western Ry		777,593		669,243
New York Central Lines:				
Chicago River & Indiana R. R		488,773		744,257
New York Central R. R	d	18,256,400		2,430,101
Pittsburgh & Lake Erie R. R		1,367,882		3,072,687
New York, Chicago & St. Louis R. R	d	4,410,434	d	210,412
New York Connecting R. R	d	181,745	d	605,346
Newburgh & South Shore Ry	d	156,120	d	92,397
Norfolk & Western Ry		16,984,376		21,326,183
Norfolk Southern R. R	d	1,103,406	d	498,043
Northern Pacific Ry	d	1,991,407		8,902,333
Oklahoma City-Ada-Atoka Ry	d	121,122	d	99,077
Pennsylvania System:				
Long Island R. R		2,999,648		5,101,325
Pennsylvania R. R		13,573,536		19,941,498
Peoria & Pekin Union Ry		87,947		39,130
Pere Marquette Ry	d	3,044,611	d	1,863,081
Pittsburg & Shawmut R. R	d	180,485	d	42,671
Pittsburgh & West Virginia Ry	d	433,529		4,339
Pittsburgh, Shawmut & Northern R. R	d	163,739		67,475
Reading System:				
Atlantic City R. R	d	669,600	d	741,741
Central R. R. of New Jersey	d	1,828,083		31,326
Reading Co		4,228,789		3,314,928
Richmond, Fredericksburg & Potomac R. R.		389,341		937,873
Rock Island System:				
Chicago, Rock Island & Gulf Ry	d	899,163		517,233
Chicago, Rock Island & Pacific Ry	d	9,057,637	d	903,778
Rutland R. R	d	41,460	d	101,128
San Diego & Arizona Ry	d	1,110,350	d	908,702
Seaboard Air Line Ry	d	9,528,174	d	7,110,747
Southern System:				
Alabama Great Southern R. R	d	408,499		293,278
Cincinnati, New Orleans & Texas Pacific Ry.		296,546		622,176
Georgia Southern & Florida Ry	d	109,266	d	120,606
Mobile & Ohio R. R	d	2,237,427	d	2,002,504
New Orleans & Northeastern R. R	d	758,239	d	656,619
New Orleans Terminal Co	d	6,441		385
Northern Alabama Ry	d	168,367	d	167,482
Southern Ry	d	10,955,562	d	5,609,813
Southern Pacific System:				
Northwestern Pacific R. R	d	1,629,328	d	1,752,259
St. Louis Southwestern Lines	d	3,471,325	d	291,917
Southern Pacific Transportation System	d	5,779,631		7,138,372
Spokane, Portland & Seattle Ry	d	3,630,652	d	2,493,880
Tennessee Central Ry	d	82,250	d	20,009
Terminal R. R. Association of St. Louis	d	1,570,005	d	803,236
Texas Mexican Ry	d	234,873	d	317,474
Toledo, Peoria & Western R. R		36,775		66,218
Toledo Terminal R. R	d	70,217		107,223
Union R. R. (of Penna.)	d	1,865,193	d	363,469
Union Pacific System:				
Los Angeles & Salt Lake R. R	d	1,059,449	d	1,372,071
Oregon Short Line R. R		224,073		2,658,188
Oregon-Washington R. R. & Navigation Co.	d	4,775,856	d	3,140,345
St. Joseph & Grand Island Ry		293,539		306,947
Union Pacific R. R		26,177,262		31,842,311
Utah Ry.	d	36,518	d	1,195
Virginian Ry.		2,074,399		3,256,505
Wabash System:				
Ann Arbor R. R	d	411,763	d	404,884
Wabash Ry.	d	6,673,695	d	7,050,746
Western Maryland Ry		612,893		1,011,012
Western Pacific R. R	d	2,230,177	d	2,127,162
Wheeling & Lake Erie Ry		435,084		753,743
Wichita Falls & Southern R. R	d	56,639	d	101,565

a Includes Atchison, Topeka & Santa Fe, Gulf, Colorado & Santa Fe, and Panhandle & Santa Fe.
b Not included in totals.
c Includes Southern Pacific Company and Texas & New Orleans R. R.
d Deficit or other reverse items.

Surcharge Continued Until September 30

WASHINGTON, D. C.

CONTINUATION for an additional period of six months of the emergency freight surcharges authorized in Ex Parte No. 103 will be permitted by the Interstate Commerce Commission, according to its report announced on March 13, dated March 7, from which Commissioners Eastman, McManamy, Porter, and Tate dissented. Commissioner Mahaffie concurred in the results.

The opinion is expressed that the surcharges, as such, should be brought to an end, but that a reasonable period should be allowed during which the railroads will have an opportunity to file tariffs in the usual way proposing such readjustments in their rates, in the light of the impending discontinuance of the surcharges, as they feel they can justify. The commission will, therefore, permit blanket tariffs to become effective on short notice without suspension, continuing in effect until and including September 30 the present surcharges, as such, except that there shall be no surcharges on non-ferrous ores and concentrates and only one surcharge of six cents per ton in connection with the transportation of lake-cargo coal from the originating mine to the ultimate destination. At present there is a double surcharge, one on the movement from the mine to the lake port and another on the movement from the lake dock to the interior.

The commission also expressed the opinion that it would be advantageous for the railroads to continue the present loaning plan for the limited period during which they are authorized to continue the surcharges. In asking for a continuation beyond March 31 without limitation the railroads had proposed that the plan of pooling the revenues from the surcharge through the Railroad Credit Corporation be discontinued.

The surcharges, ranging from 6 cents a ton to 2 cents a hundred pounds, excluding some commodities, largely agricultural products, have been in effect since January 4, 1932, having been allowed by the commission in lieu of the 15 per cent general advance asked by the railroads in 1931, and produced additional revenue during the year amounting to $63,000,000. In the general proceeding the commission found it impracticable to go into questions as to the continued application of surcharges on certain individual commodities as to which protests were made by shippers but stated that matters of this kind should be submitted first to the railroad traffic committees, it being understood that parties dissatisfied with the results always have the right to bring the matter in dispute to the attention of the commission by formal complaint.

Extracts from Report

"The problems with which the railroads are confronted today cannot be solved by general increases in freight rates," the report said. Extracts from the majority report follow:

Figures are now available for the calendar year 1932 which show that the receipts from the surcharges amounted to $62,663,882, credited to freight revenue, and $1,066,917 for switching, floatage and lighterage. These two sums together amounted to 2.6 per cent of the freight revenue and 19.1 per cent of the net railway operating income.

These percentages are based on a comparison of the reported surcharge with the reported revenue and income. They do not represent what the weighted average per cent of increase in rates would have been if the volume of traffic actually carried had moved at the rates in effect in 1931 plus the surcharges without the many reductions made to meet competition. But such a refinement would probably be of little value.

Respondents' officials expressed the opinion that the surcharges had not seriously interfered with the free flow of traffic, that they had resulted in a net increase in revenue, and that the addition thereof to the basic rates resulted in reasonable rates. No attempt was made to state the total amount of the net increase in revenue and it is apparent that any estimate thereof must be largely speculative because there are too many uncertain elements which enter into the calculation. The receipts by the Railroad Credit Corporation cannot correctly picture the situation because they include the surcharges on basic rates which have been reduced below the former level, for competitive and other reasons, and they take no account of revenue lost entirely to the rail carriers by reason of the diversion of traffic to competing transportation agencies, or for other reasons.

The shippers, generally speaking, evinced little interest in the manner of disposition of the surcharge revenue but many of them, including some who do not oppose continuation of the surcharges, took exception to respondents' contention that they have become an integral part of the rate fabric. It is insisted that, if an extension is permitted, the surcharges should be separately published as at present and should be effective only for a specified and limited period. Suggestions as to the length of that period range from six months to one year.

In the supplemental report in this proceeding we briefly and pointedly stated the nature of the increases authorized in our original report and the controlling reason for our action in authorizing such increases.

Although, because of our desire to avoid delays, which, we felt, would at that time have been injurious to the general public, including the carriers, and in reliance upon the carriers applying the funds derived from the authorized surcharges in aid of financially weak railroads in accordance with the purpose expressed in our original report, we modified our original report to the extent of relieving the carriers from the necessity of complying with the pooling plan therein described, we in nowise changed the temporary emergency nature of the increases or our expressed opinion as to the purpose to which the revenue derived therefrom should be devoted.

Economic conditions have grown progressively worse since the surcharge plan was authorized. The price level of practically all commodities has continued to fall. The abnormal relation of freight rates, as a whole, to the general level of commodity prices is, therefore, now much more pronounced. The carriers in many instances have found it impossible, due to the above described conditions and the resulting increased competition with other agencies of transportation, to maintain the rates and surcharges as originally established. In some cases the surcharges were removed, and in others, although the surcharges as such were retained, the basic rates were reduced sufficiently so that when the surcharges were added to them the total was equal to or less than the former basic rates. In both cases the surcharges have, therefore, as a practical matter, disappeared. The extent to which such reductions have occurred cannot be accurately determined upon this record but it appears to have been considerable.

The anticipation, when the surcharges were originally authorized, that the number of railroads which would fail to earn their fixed charges would be greatly exceeded by those which did was not realized. Instead, 128 Class I carriers operating approximately 83 per cent of the total mileage did not earn fixed charges in 1932, without the surcharges. This condition resulted from the unprecedented decline in railroad freight traffic since 1931. The revenue turned over to the Railroad Credit Corporation fell far short of expectations based upon 1931 traffic, and that institution, although helpful, turned out to be a minor and the Reconstruction Finance Corporation the major prop to railroad finances.

It is evident that the surcharge plan, as a temporary emergency measure, although productive of some net increase in revenue, falls far short of solving the problem of credit now confronting the railroads generally. Continuance of the surcharges without limitations or condition would be equivalent to a general increase in freight rates. This clearly is not justified upon the present record. The problems with which the railroads are confronted today cannot be solved by general increases in freight rates. Certainly any substantial increase would result in permanent injury to the railroads. Their low earnings are not the result of low rates. The present relation between commodity prices and freight rates was discussed upon the record to some extent but that general question will be presented in another proceeding at an early date and cannot be determined here. In our original report herein, under the heading of The Railroad Future, we discussed certain matters of utmost importance to the future of the railroads. We wish to again emphasize the recommendations which we there made.

Commissioner Eastman, saying that "time and experience have amply sustained our analysis of the dangers" of the proposal made originally by the roads for a 15 per cent increase, said that the surcharge plan was allowed only as an extraordinary remedy for the situation as it then existed and should be no longer continued, except that he would not object to allowing the roads a reasonable opportunity to combine the surcharge with the basic rate by an increase in the latter in some cases where the basic rates have been reduced. In a large number of instances, he said, the railroads have found it impossible to maintain the rates as increased by the surcharges but have retained the surcharges while reducing basic rates.

The surcharge plan was in the nature of a special tax assessed upon industry for what was believed to be the general good, and which we made it possible to assess through the exercise of our discretion in permitting tariffs to go into effect without suspension. Such exercise of discretion was, I believe, justified as a matter of statesmanship under the extraordinary conditions then existing. The special purpose of the plan, however, has failed and that purpose is to be altogether abandoned. Moreover, conditions have so changed as to make such a special tax much less justifiable.

In the profound economic disturbance which now exists, the railroads have been and are, so far as their rates are concerned, a sheltered industry. I have figures before me which show that in 1931 the average ton-mile revenue was 45.7 per cent higher than in 1913. If adjustments are made for the great increase in average length of haul since 1913 and for the change in proportions of major traffic groups, the level in 1931 was probably at least 68 per cent higher than in 1913. The figures are not available for 1932, but such reductions in rates as were made in that year were in whole or in part offset by the surcharge increases. Contrast this with the well-known facts as to what has happened in the case of commodity prices generally, with the exception of steel rails, where the price, most unfortunately for the railroads and for the country, has been maintained near the pinnacle by the stubborn will of producers without insight or vision.

This major dislocation between commodity prices and the charges for transportation service may be one of the factors which is impeding the recovery of business, and it can be cured in only two possible ways, either by inflating the prices of commodities or deflating the freight rates. If it is such an obstacle to recovery, this dislocation is doing harm rather than good to the railroads. I shall not discuss this subject further, because it is presented in an important petition which is pending and is shortly to be argued before us, and which I do not wish to prejudge. It is sufficient to say that in the face of these facts I cannot join in a continuation of the policy which the surcharge plan reflects of increasing freight rates under present economic conditions. Nor am I convinced that the rates so increased would, in many instances, be just and reasonable.

Commissioner Porter said that the policy of the majority in continuing these surcharges with the thought that it will help the carriers is an "iridescent dream" and that to continue the increases "is to fly in the face of an economic trend, world-wide in its character and as irresistible as Niagara." It would be conservative to say, he added, that of the 101,657 tariffs filed last year at least 80 per cent provided for reductions in rates voluntarily made by the carriers.

The majority report, in discussing the present situation of the railroads, gave the following comparison of the rate of return in recent years as computed with reference to property investment and the commission's valuation data:

The rate of return on the recorded property investment of Class I carriers (excluding switching and terminal companies) fell from 4.81 per cent in 1929 to 3.27 in 1930, 1.99 in 1931, and for 10 months of 1932, 1.15 per cent. If in place of the recorded property investment there be substituted the value taken by us in *Increased Rates*, 1920, 58 I. C. C. 220, plus subsequent net additions and betterments, but without consideration of depreciation as affected by the further lapse of time, changes in maintenance standards, and additions of new property, these percentages would be, respectively, 5.22, 3.54, 2.13, and 1.23.

Transport Problem Analyzed by N. T. C. Staff

UNDER the title "The American Transportation Problem," the Brookings Institution, Washington, D. C., has just published a comprehensive analysis of the present situation of transportation in this country, leading up to conclusions as to the need for a new unified national transportation policy, instead of a series of unrelated and often antagonistic policies carried out by a variety of government agencies, prepared for the National Transportation Committee by Harold G. Moulton, president of the Brookings Institution, and associates, who served as a research staff for the committee. The 985-page volume represents the results of a four-months investigation conducted in collaboration with members of the regular staff of the institution and several other specialists, which was to some extent made the basis for the recommendations made public by the committee on February 15, but the conclusions are those of Dr. Moulton and of his associates who contributed chapters and differ in many respects from those announced by the committee.

In the final chapter on "The Need For a New Transportation Policy" Dr. Moulton urges that federal regulation of all forms of transportation be centralized under the Interstate Commerce Commission.

The chapter on "Trend of Financial Condition", much of which was contributed by Dr. Charles O. Hardy, reaches the conclusion that the recovery of the railroads from 1921 to 1929 was substantial, though it did not quite restore to the carriers the financial strength they enjoyed in the period from 1906 to 1913, and that the railroads on the whole enjoyed during this period a credit position well above the average of corporate industries generally and were able to attract capital at least proportional to their importance in the national economy. The next chapter, on "Railroads and the Depression", to which Dr. Hardy also contributed, says it is obvious that the present condition of the railways "is at the same time a result of the depression and an important contributing cause of its continued severity." Until the volume of traffic increases and commercial banks are once more willing to finance the roads for their current requirements, and until the bond market improves, the opinion is expressed that the railroads will continue to be almost entirely dependent upon emergency credit institutions.

In the chapter on "Taxation" Dr. Benjamin P. Whitaker finds that "it does not appear that the railroads have been treated with any marked inequality under the principles of existing tax laws as compared with other industries," but that such a large proportion of the cost of government is now apportioned according to property ownership that the railroads, which must necessarily employ large amounts of tangible property in their business, "are subjected to more severe burdens on their earnings than other industries in times of drastically reduced business."

Several chapters in the part devoted to "The Financial Structure and Ownership of the Railways," were contributed by Dr. Moulton. He finds the data "sufficient to show that the financial interests involved in the maintenance of the stability and earning power of American railroads are substantially those of the entire community." Dr. Moulton shows clearly that since "the base on which the roads are supposed to be allowed to earn a return, if they can, is determined by the value of the property," and the value of the property is independent of the capitali-

zation, a capital readjustment "could not of itself result in lower rates," and "in short, the nominal capitalization of a railroad has no real significance."

Under the caption "Should There Be a General Decapitalization," he remarks that within the past year or so the question of over-capitalization has come up in a form entirely different from the traditional issue and it is now urged that the railroads are over-capitalized, not in the sense of having a volume of stocks and bonds which is excessive in proportion to the original cost of reproduction value of the properties, but in the sense that the actual investment is greater than is justified by the current and prospective levels of traffic and of commodity prices. It is obvious, he says, that when a road is paying no dividends nothing can be saved for the shipper or the railway worker by cutting the nominal amount of the stock and "if the question is viewed from the standpoint of the equities, either of the employees or of the rate-paying public as against the owners, there is no force in the suggestion that the stock capitalization of the roads should be cut down."

The really cogent argument for reducing the proportion of funded debt to stock equity, as he sees it, lies in its bearing, not on the level of rates, but on their flexibility, because "one of the most unfortunate aspects of the railroad situation lies in the rigidity of the whole structure of railroad rates, wages, and charges in the face of changing business conditions."

Regarding the increase in railway investment since 1920, Dr. Moulton finds that the figures seem to confirm the conclusion that the added investment did justify itself in terms of the reduction of operating costs and that although the new investment under present conditions cannot pay its way, "reasoning after the event is of little significance," as "all industries and most government units are burdened with capital investments which they would not have made if they had foreknown the slackened rate of business activity of 1931 and 1932."

"If perpetual interest-bearing obligations (substantially equivalent to the guaranteed leased line stocks now outstanding in limited amount) were substituted for obligations with a fixed maturity date, a large part of the objection to funded debt would disappear. A very large part of the present distress of the railroads is the result, not of excessive interest charges, but of inconvenient maturities. . . But the practice of financing new capital needs on short-term notes ought to be definitely abandoned, and capital instruments without maturity should be substituted for the outstanding debt as rapidly as maturities and reorganizations make it possible."

Two chapters on reorganization—current practice and proposed changes, were written before the passage of the railroad reorganization bill but criticisms are included of some features of the proposed legislation. Legislation is suggested providing that when a road confessed insolvency, or defaulted on its interest charges, or failed to pay its obligations at maturity, its affairs would be put in charge of two receivers appointed by the Interstate Commerce Commission from its professional staff for operation for a reasonable period in order to determine whether default was due to temporary conditions or to fundamental weaknesses in its capital structure. Particularly, reorganizations would not be carried through merely because a road had not made adequate provision for meeting its financial responsibilities in an unprecedented depression.

The part devoted to the regulation of the level of railway rates includes chapters, by Dr. Moulton, on "The Valuation Plan," "The Recapture Experiment," "Valuation Principles," and "The Utility of Valuation." The conclusion is reached that physical valuation data have not been used by the commission during the past 12 years as a means of adjusting the general level of rates from year to year so as to yield the railroads a fair return and the author agrees with the commission that it is "wholly impracticable to adjust rates so as to yield annually a given return, and that it is accordingly unwise and undesirable to continue these provisions of the law."

On the ground that in the years from 1923 to 1929 the earnings of the roads as a whole, although averaging less than 5.75 per cent, were nevertheless high enough to attract an adequate volume of capital to the industry, the statement is made that "it would appear, therefore, that the rate of 5.75 per cent, which was set in 1922 as a fair rate, was somewhat higher than necessary", but that "the real weakness of the situation is found in the fact that it was only in the good years from 1923 to 1929 that one could with assurance say that the return to the railroads was high enough to attract adequate capital."

The conclusion is reached that "physical valuation played little, if any, role in the adjustment of rates during this whole period" and that individual rate changes were initiated not with a view to affecting the general level of rates but merely for the purpose of establishing more satisfactory individual rates, but that the commission's valuation data have performed one very important service in showing that the roads as a whole "are substantially undercapitalized" and that the commission's valuation figures vary but little from the railroads' own book values.

"The attempt to regulate the general level of rates as provided under the Transportation Act has failed", Dr. Moulton finds, but after discussing the new rule of rate-making proposed by the commission and embodied in the Rayburn bill he says that "given a railroad system without obsolete lines, with properly adjusted capital structure, and with increased efficiency of operation, this rule of rate-making will amply safeguard the public interest."

In Part V, on "Water Transportation", Adah L. Lee collaborated with Dr. Moulton and the views expressed are those which have been covered in previous books by Dr. Moulton on this subject. Detailed analyses are given to show that "railway freight transportation is very much cheaper than inland canal and river transportation." Because there has been so much controversy on the subject an analysis given of the railway land grants from which the conclusion is reached that these "subsidies" to the railways, although offset by services rendered to the government at reduced rates, represent no more than about 4 per cent of the investment in the Class I railways as a whole, which is compared with "a subsidy of at least 85 per cent in the case of waterways."

Three chapters on highway transportation were contributed by Charles L. Dearing. He concludes that on the whole highway users are now paying for those highways which are of general use, although local highways are still being paid for, in the main, by "local beneficiaries," but that this is a very different thing from paying taxes for the general support of government, and at the present time he finds it impossible to answer the question whether passenger automobile traffic is subsidizing the truck and the bus or *vice-versa*. In some states the passenger car may be contributing disproportionately, while in other states the opposite may be true.

Other chapters are devoted to "Possibilities of Co-Ordination of Rail and Motor Transport," "Oil and Gasoline Pipe Lines," "Air Transport."

Part VIII, "Stabilization of the Railroad Industry," includes chapters on readjustment of rates and costs,

the problem of terminal unification, transportation and city planning, methods of effecting terminal unification, and "Consolidation and Efficiency." The declaration is made that a considerable reduction in railroad rates is "clearly essential to the readjustment of production costs to purchasing capacity and hence to a resumption of business activity" but that a reduction would doubtless mean, immediately speaking, an increase in railroad operating deficits, so that, at the same time that rates are being adjusted downward, it is necessary to cut costs. The economies of the near future, it is stated, will depend primarily upon the extent to which the wastes which are incident to the duplication of services and costs under a competitive system can be eliminated, and attention is called to the fact that "the railroad managers have been confronted with certain very time-consuming problems which have militated against concentrated attention upon the business of transportation." Reference is made to the problems connected with the system of legislation and commission regulation, to financial issues incident to acquisitions and potential mergers or consolidations, and to labor problems.

The chapter on consolidation discusses the advantages and disadvantages of various proposed plans and reaches the conclusion that little or no progress has been or is likely to be made along the lines of voluntary consolidation. "If our railroads are to be consolidated, compulsion is plainly necessary. Whether such consolidation is possible under the power of eminent domain vested in the government, is said to be a constitutional question which would have to be decided by the courts."

Part IX, "Reorientation in Transportation Regulation," for which Dr. Fred W. Powell is primarily responsible, points out "that there has always been a railroad problem" but that although the principle of protecting the public interest, whatever the form of transportation, has been accepted by both state and national authority, we still have the widest diversity in practice, the regulation of railroads extending to financial policies and practices, rates, service, and safety; while in the case of other forms of transportation it is confined in the main to police and protective functions, and there has been as yet no agreement upon common objectives.

A chapter on "Obsolescent Lines," contributed by Dr. Wilfred Eldred, transportation specialist, discusses various bases for estimating the extent of mileage that perhaps ought to be abandoned, and includes a summary statement that if we assume 250,000 ton-miles of freight per mile of line annually to be essential to profitable operation, 73,311 miles were obsolete in 1928 before the depression began, of which 57,742 miles were on Class I railroads. If 100,000 ton-miles (or 10 cars of freight a day) be assumed to mark the dividing line, 39,415 miles would be placed in the obsolete category, of which 28,379 miles belonged to Class I roads. It was estimated that the 73,311 miles carried less than two per cent of the freight traffic of the country. An estimate of the investment in the 39,000 miles was placed at $1,160,000,000, or approximately 4 per cent of the total railway investment.

Entirely aside from the conclusions reached the book is a remarkably complete and up-to-date presentation of the statistical and other facts of the present transportation situation and of the historical developments that have led up to it which would otherwise be available only from a large number of sources. The subjects are impartially presented and although the various chapters deal with most of the controversial questions that have been raised in several years with relation to the transportation problem conclusions are seldom expressed without a presentation of the arguments on both sides.

The book contains 895 pages, in addition to the text of the report of the National Transportation Committee, and a select bibliography. It is arranged in nine parts: Introduction, Factors Affecting Railway Net Income, Financial Structure and Financial Policies, Regulation of the Level of Rates, Water Transportation, Highway Transportation, Other Transportation Agencies, Stabilization of the Railroad Industry, and Reorientation in Transportation Regulation. These parts are further subdivided into 37 chapters. The book is being sold for $3.

Freight Car Loading

WASHINGTON, D. C.

REVENUE freight car loading in the week ended March 4 amounted to 477,827 cars, an increase of 18,748 cars as compared with the week before, which included a holiday, but a decrease of 81,652 cars as compared with the corresponding week of last year. Presumably loading was somewhat reduced as the result of the effects of the state bank holidays which were in effect in many states during a large part of the week. However, increases as compared with the week before were shown in the loading of miscellaneous freight, l.c.l. merchandise, forest products, and coke. The summary, as compiled by the Car Service Division of the American Railway Association, follows:

Revenue Freight Car Loading

Week ended Saturday, March 4, 1933

Districts	1933	1932	1931
Eastern	113,690	131,020	164,309
Allegheny	92,187	113,118	149,656
Pocahontas	31,246	32,972	40,785
Southern	76,692	86,980	114,927
Northwestern	54,987	63,330	87,771
Central Western	67,749	83,929	106,190
Southwestern	41,276	48,130	59,577
Total Western Districts	164,012	195,389	253,538
Total All Roads	477,827	559,479	723,215
Commodities			
Grain and Grain Products	27,861	31,371	41,553
Live Stock	14,025	16,952	18,439
Coal	92,166	95,367	129,123
Coke	4,863	5,084	7,970
Forest Products	15,240	20,489	34,024
Ore	1,364	2,096	5,344
Mdse. L. C. L.	162,052	191,504	220,467
Miscellaneous	160,256	196,616	266,295
March 4	477,827	559,479	723,215
February 25	459,079	535,498	681,221
February 18	514,390	572,265	713,156
February 11	501,320	561,535	720,689
February 4	483,192	573,923	719,053
Cumulative total, 9 weeks	4,346,304	5,069,471	6,430,545

The freight car surplus on February 14 amounted to 670,228 cars, a reduction of 21,359 as compared with the number two weeks before. The total included 378,245 box cars, 214,840 coal cars, 32,571 stock cars and 15,174 refrigerator cars.

Car Loading in Canada

Car loadings in Canada for the week ended March 4 amounted to 34,211 cars. This was an increase over the previous week of 272 cars, but not as great as in past years, and the index number dropped from 59.25 to 57.46.

	Total Cars Loaded	Total Cars Rec'd from Connections
Total for Canada:		
March 4, 1933	34,211	18,049
February 25, 1933	33,939	17,668
February 18, 1933	35,879	18,899
March 5, 1932	41,773	22,919
Cumulative Totals for Canada:		
March 4, 1933	290,426	155,469
March 5, 1932	370,358	189,631
February 28, 1931	412,436	244,957

NEWS

Door-To-Door Services Extended by Pennsylvania

Joins with Baltimore & Eastern in new plan for expediting l.c.l. Shipments

Door-to-door collection and delivery of freight in either direction between Philadelphia, Pa., Camden, N. J., Wilmington, Del., Chester, Md., Baltimore, and points on the Delaware-Maryland-Virginia Peninsula as far south as Crisfield, Md., and Pocomoke, will be inaugurated on March 20, by the Pennsylvania and the Baltimore & Eastern. Tariffs covering the new service have been filed with the Interstate Commerce Commission.

An overnight service between these territories will be instituted, motor trucks on either end being utilized between the railroad and the store doors of the patrons. Every arrangement, the announcement says, has been perfected to make speed in collection and delivery the outstanding feature of the new method of handling these l.c.l. shipments.

A new schedule of reduced rates has been prepared on the basis of a minimum of 100 lb. per shipment, covering all transportation service. No other item of expense will be entailed.

The charges are all-commodities rates and all traffic, except explosives or articles of extraordinary value, will be handled at the one rate.

In addition to the foregoing, there will also be instituted on March 20 a system of collecting and delivering freight locally within the Delaware-Maryland-Virginia peninsula territory.

Furthermore, for all freight shipments originating at or destined beyond the peninsula, or Philadelphia, Baltimore, Wilmington and Chester, this collection and delivery service will be made possible through an additional charge of 5 cents per 100 lb., subject to a minimum charge of 25 cents per stop. Local collection and delivery service on Maryland intra-state traffic between points served by the Pennsylvania is also under consideration, but plans for this have not as yet been perfected.

No-Pay Holiday on I. C.

A ten-day no-pay holiday for all employees not covered by wage agreements has been adopted by the Illinois Central as a result of decreases in revenues. Employees will be off duty five days in the latter part of March and five days in the latter part of April. At present all employees, both organized and unorganized, are working under a 10 per cent reduction in pay.

A Shipper's Views on Transport Questions

We simply must have regulation of truck and bus agencies of transportation for at least one reason of paramount importance to the shipper. We must know what our competitor is paying in the way of transportation charges. Otherwise, orderly business is disrupted. Then, too, the products of our territory generally find but a limited market in our sparsely settled South and must seek the distant and far-flung markets that are highly competitive. To successfully reach these markets, we must have sympathetic, aggressive and prosperous railroads.

Truck and bus operations are weakening our railroads and destroying their ability to serve us. And please consider our Inland Waterways—the river operations of the Federal Barge Line. Consider the preference between shippers, the secret rates of this agency.

The coal business has suffered from the importation of fuel oil from Central and South America. It has barely escaped electrocution from hydro-electric power and has been near asphyxiation from natural gas. Further, along with all other business, the depression has affected earnings of the coal companies. It will be a remarkable accomplishment indeed if our commercial coal operators in Alabama, other than the favored river bank mines, are able to survive the competition from Uncle Sam's Barges. Bear in mind, shippers, that while Uncle Sam is in our business today, he may likewise be your competitor tomorrow—and backed by the resistless power of taxation.

From an address by A. W. Vogtle, traffic and sales manager, De Bardeleben Coal Corp., Birmingham, Ala.

Allegheny Advisory Board Meeting Postponed

The regular Spring meeting of the Allegheny Regional Advisory Board (headquarters Pittsburgh, Pa.) has been postponed to April 13 because of the bank holiday.

North Western to Move City Ticket Office

The Chicago & North Western will move its Chicago city ticket office from Clark and Adams streets to La Salle and Adams streets on April 1. This is the second railroad, the Pennsylvania being the first, to move its ticket office into the financial district of that city.

Warehousing and Storage Practices Are Criticized

Proposed report in Ex Parte 104, part 6, is made public by the I. C. C.

The Interstate Commerce Commission on March 13 made public a proposed report by W. P. Bartel, director of its Bureau of Service, and Examiner W. M. Cheseldine, on part 6 of its investigation in Ex Parte No. 104 into the operating practices of carriers, recommending that the commission find that the practices engaged in by rail carriers serving the port of New York district as to commercial warehousing and related matters, including charges assessed and allowances made in connection therewith, result in numerous violations of the interstate commerce act. The examiners also say that these practices afford reasonable grounds for the belief that the Elkins act is being violated and recommend that the carriers "be admonished to take corrective action, failing which the commission will enter an order in conformity with its findings." They also recommend that carriers serving other ports and terminals be admonished to adjust their practices and charges in conformity with the principles announced, and that failure of the carriers to so adjust their practices and charges should be deemed sufficient reason for the institution of further investigations.

This part of the investigation was primarily brought about by complaints of warehouse operators located in the New York district that warehouses owned by the carriers or in which they have financial interests were being operated in a manner which precluded the complaining warehouses from obtaining much, if any, of the business.

The report is a voluminous one, reviewing in detail the evidence as to the practices of the various roads and affiliated companies. "While the carriers charge all shippers alike the tariff rates for rail transportation," it points out, "it is obvious that the assessment of non-compensatory warehousing charges and rental to some shippers and not to all is equivalent to a deduction from the charges for transportation to some shippers and not to others for like and contemporaneous service. These violations are added to in some cases by the free loading and unloading of carload freight, or payment of allowances therefor, and the handling of freight into and out of storage at less than compensatory rates. . . . . Again, the competitive waste involved in the practices dealt with herein is deserving of most careful consideration.

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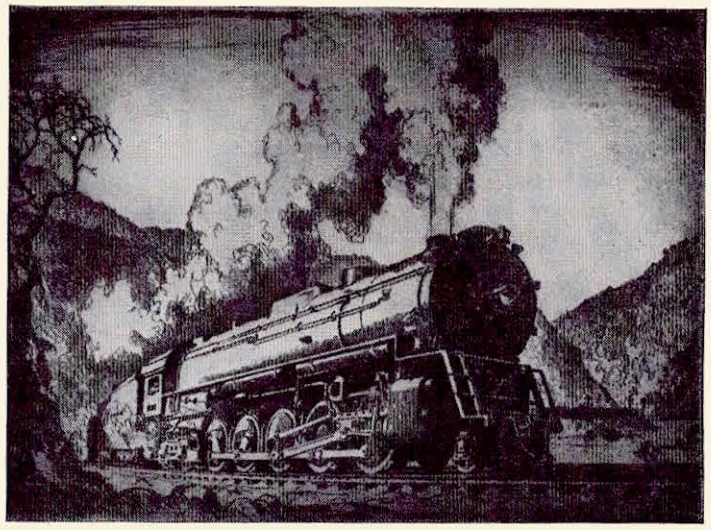


WHAT MODERN LOCOMOTIVES *mean* IN HAULING CAPACITY

"The tonnage a railroad moves per hour is entirely dependent upon locomotive horsepower. The following figures show the greatly increased capacity of modern locomotives:

	1912	1922	1932
Total Horse-Power	475 H. P. per driving axle	575 H. P. per driving axle	Over 1,000 H. P. per driving axle

—*Wall Street Journal, February 24, 1933*

ECONOMY DEMANDS THE POWER THAT IS LACKING IN THE OLDER LOCOMOTIVES

Only by a vigorous locomotive replacement program can the railroad plant be made properly efficient.

LIMA LOCOMOTIVE WORKS, INCORPORATED
LIMA OHIO

LIMA LOCOMOTIVE WORKS INCORPORATED

Regardless of the advantages of such practices which were sought by the carriers in the beginning, a preferred group of large shippers are now the sole beneficiaries, and are so at the expense of the carriers and the general shipping public."

The report is concluded with a series of 11 recommended findings, of which the first is "That the practices of respondents as discussed herein dissipate their funds and revenues, are not in conformity with honest, efficient and economical managements as contemplated by the interstate commerce act, and are not in the public interest."

Rates on Anthracite Reduced

Freight tariffs have been filed with the Interstate Commerce Commission showing new rates on anthracite coal from Pennsylvania mines to Chicago and points in Central Freight Association which are approximately $1 a ton less than the present rates, to become effective on April 1.

P. R. R. Exhibits Electric Locomotive at Philadelphia Station

One of the Pennsylvania's electric passenger locomotives now being used in regular service between Philadelphia, Pa., and New York, has been on exhibition this week in Broad Street station, Philadelphia. During the exhibition an attendant has been constantly in charge to explain the details of operation, and give any technical or general information about the locomotive's construction and design.

Georgia Denies L. & N. Plea to Reduce Fares

The Louisville & Nashville, which, on April 1 filed notice of intention to reduce the basic passenger rate to three cents a mile, omit the Pullman surcharge and establish a two-cents-a-mile rate in coaches, for a period of six months as a means of stimulating passenger travel between all points on the system, has been denied permission to place the rates in effect in Georgia by the Georgia Public Service Commission. Only a small mileage of lines is affected by the state order.

U. S. Chamber to Continue Rail Studies

New developments in the railroad situation since the adoption of its Referendum 62 last Fall will be considered at a meeting on March 13, of the Special Committee on Railroads of the Chamber of Commerce of the United States. Among the matters to be considered are government policy in relation to the financial and credit needs of the carriers, the railroad rate and labor situation, proposals as to railroad consolidation and other recommendations heretofore made for dealing with outstanding railroad problems.

Indiana Creates New Commission

The administration public service commission bill, which has just been passed by the Indiana legislature, creates a new commission of three members and a public counselor, these to replace the existing commission of five members. The new commissioners named by Governor Paul V. McNutt are Perry McCart, an attorney of Paoli, and at one time general solicitor of the Chicago, Indianapolis & Louisville; Mole Cook, a fire equipment manufacturer of Logansport, and Samuel Trabue, mayor of Rushville. Sherman Minton, an attorney of New Albany, was appointed public counselor.

Indiana Sales Tax

A combination sales and income tax law providing that all utilities in Indiana shall pay one per cent of their gross income to the state, exempting $1,000 and taxes paid through other channels, will be placed in effect in that state on May 1, following passage by the state legislature and approval by the governor. An exemption is made on gross income that is derived from business conducted in commerce between Indiana and other states. The law also provides that all officers and employees earning more than $1,000 a year shall pay one per cent of their earnings in excess of $1,000. No provision is made for deductions for dependents.

Truck Accidents in Pennsylvania

The Associated Railroads of Pennsylvania has issued a compilation of highway accidents involving motor trucks operating in that state during the six months, April to September, 1932, inclusive. The list, having been compiled from local newspaper files at various points in Pennsylvania, "is not represented to be a complete or official record of all such accidents," but it nevertheless gives data on 655 accidents in which a total of 145 persons were killed and 751 injured. Also, in the six months under review, the compilation shows, four animals were killed, one bridge was destroyed and there were 155 miscellaneous accidents, other than those involving death or injury.

Passenger Train Service Restored

The "Merchants' Limited," fast New York-Boston train of the New York, New Haven & Hartford, taken out of service on March 8 because of the bank holiday, was again put in service early this week, and the "Yankee Clipper," also taken off, is to resume its trips on Monday, March 20. The numerous runs on other schedules—between New York and Springfield and in the Boston suburban district—have been restored.

On the Pennsylvania and the New York Central curtailed service is still in force as the *Railway Age* goes to press. To take the place of the Pennsylvania's "Rainbow," westbound No. 43, sleeping cars will leave New York on the Pittsburgher, leaving at 11:59 p. m. The morning trains to and from Atlantic City and other local New Jersey services continue suspended.

The New York Central has not as yet announced any restorations. The Exposition Flyer, No. 39, leaving New York at 12:30 p. m. will, for the time being, make the stops of No. 5, the Mohawk, which was taken off.

Combination 40- to 75-Cent Meals on P. R. R. Diners

Combination meals ranging in price from 40 to 75 cents will soon be available to passengers on all hourly trains of the Pennsylvania between New York and Philadelphia, Pa. One dining car has been serving such meals for several weeks and extension of the plan to all trains on the New York-Philadelphia run awaits only the equipping of the remaining eight diners assigned to these trains.

Under the new arrangement, one end of the dining car will be fitted with a counter on each side, running lengthwise of the car. Room will be provided for ten persons, five at each counter, at which a "tray service" meal can be had. In the other end of the car, regular dining car service will be given, with meals served in courses the same as at present. The two sections of each car will be separated by hanging curtains. All of the food will be prepared in the kitchen of the car. The car, which has been in use for several weeks, has proved to be popular with travelers.

View of P. R. R. Dining Car with Section Equipped for Serving Low-Priced Combination Meals

Continued on next left-hand page

BUY FOR THE YEARS TO COME

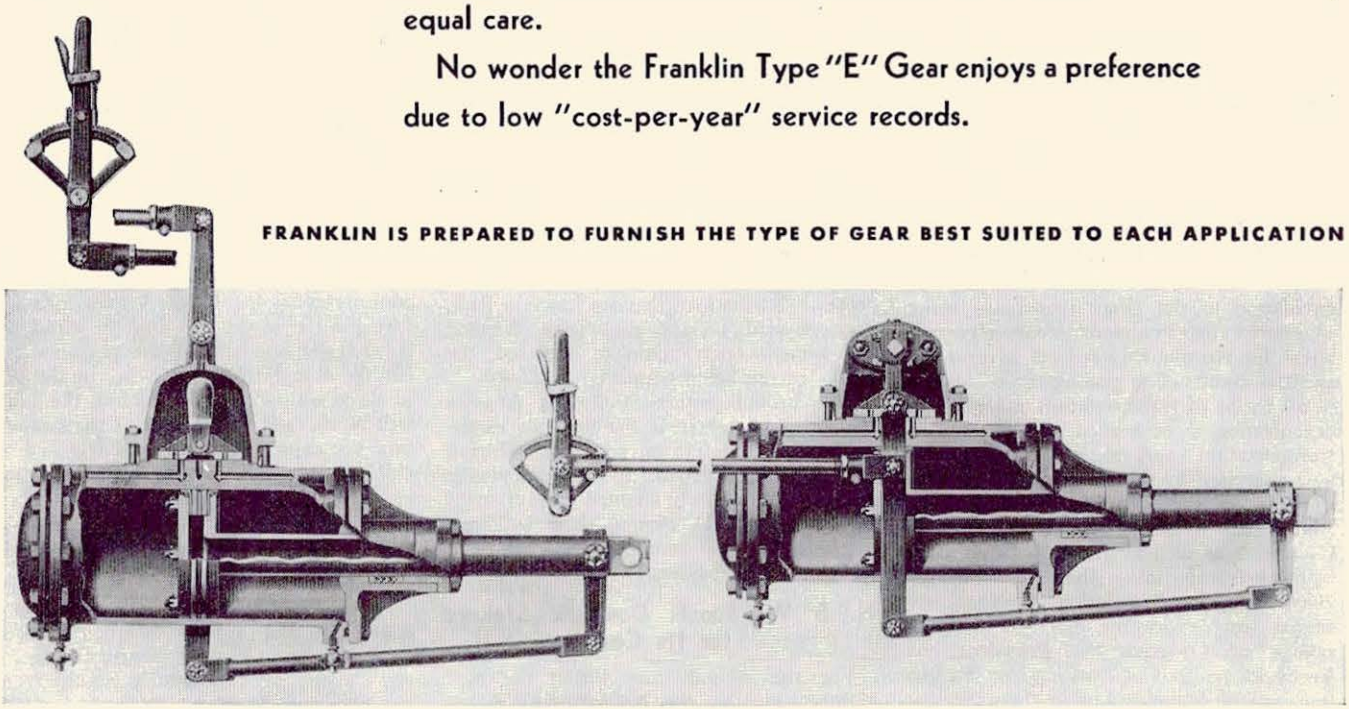
The remarkable 10-year, low maintenance record of Franklin Type "E" Power Reverse Gears is due not only to their design but also to the selection of the finest materials.

In the construction of the integral trunk and piston, for example, projectile engineers were consulted. The piston and piston rod were constructed by the same machinery as is used for making rifles, resulting in a very strong and absolutely true part, uniform in texture.

After ten years of operation the trunk pistons on the first gears placed in service show practically no wear and have required absolutely no maintenance.

Other parts of the Franklin gear have been selected with equal care.

No wonder the Franklin Type "E" Gear enjoys a preference due to low "cost-per-year" service records.



FRANKLIN IS PREPARED TO FURNISH THE TYPE OF GEAR BEST SUITED TO EACH APPLICATION

FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK CHICAGO MONTREAL

Allegheny Board Expands Activities

The Allegheny Regional Advisory Board, pursuant to a resolution adopted on December 15, has entered into a program for extending the scope of the advisory board's work. In accordance with the program for expansion, a Committee on Expanded Activities, consisting of six members, has been formed to make a thorough study of all subjects properly presented. In order to facilitate its investigations and at the same time insure active and unbiased conclusions, 10 subcommittees have been selected to study tariffs; transit privileges; claims and claim prevention; train schedules; packing and stowing; weighing, storage and demurrage; the Interstate Commerce Commission; classifications; trap cars; and the Bureau of Explosives. Reports of the Committee on Expanded Activities are made at the regular meetings of the board.

Diesel Unit for Main Line Service

A Diesel-powered unit for main-line service, a combination car with post office and baggage compartments, capable of hauling three passenger coaches, developed by the St. Louis Car Company, St. Louis, Mo., and the Ingersoll-Rand Company, New York, and exhibited at the St. Louis Union station on March 9, has been placed in test service on the Louisville & Nashville between Lexington, Ky., and Louisville, and between Louisville and Birmingham, Ala. The unit is 75 ft. long, weighs 104 tons and has two 300-hp. Diesel engines. The electric current from two generators, directly connected to the Diesel engines, drives four motors which transmit power to the truck wheels. The builders claim a maximum speed of 80 miles per hour and that a similar unit capable of producing approximately 1,500 hp. can be built.

Plans For Transportation Director Said To Be Under Consideration

Many unconfirmed reports have been in circulation to the effect that plans being considered by President Roosevelt's advisers for reorganizing federal government agencies contemplate placing the regulation of all forms of transportation under a new organization, to be headed by a director of transportation, and to include functions now exercised by the Interstate Commerce Commission, the Shipping Board, and the Aeronautics Branch of the Department of Commerce as well as any jurisdiction over highway transportation that might be provided for by new legislation. Under a law passed just before the close of the last session of Congress the President has power to reorganize, combine, or abolish functions of organizations in the executive branch of the government but there is some question as to whether the Interstate Commerce Commission comes within that category, although the authors of the bill appear to have considered that it did. There is also talk that new legislation would be sought before an attempt is made to make such a plan fully effective. A committee of advisers of the new President has been at work for some time on a reorganization plan, although there has been no official information as to how soon it is expected to report. In his inaugural address the President did not discuss the transportation question beyond proposing "national planning for and supervision of all forms of transportation and of communications and other utilities which have a definitely public character".

Three New Signaling Pamphlets

R. H. C. Balliet, secretary of the Signal Section, American Railway Association, announces the issue of chapters XIV, XVII and XX of the series of pamphlets entitled "American Railway Signal Principles and Practices". The prices of the first two are 25 cents to members and railroad employees and 35 cents to non-members and non-railroad employees; and the prices of chapter 20 are 35 and 45.

Chapter 14 is made up of definitions, 81 pages; and chapter 17 describes mechanical and electro-mechanical interlocking, being substantially a continuation of chapter 16, Interlocking, which was issued in 1931. Chapter 17 consists of 85 pages. Chapter 20, Interlocking Circuits, consists of 167 pages.

Sixteen chapters -16 pamphlets—in this comprehensive project have now been completed, and the whole 16 may be had for $5.05, or for $3.45 if the purchaser is a railroad man. A binder, to hold 13 chapters, is for sale at one dollar.

Earthquake Causes Little Damage to Railways

Slight damage to property and a short interruption of service were the only effects, affecting railroads, of the earthquake that occurred in southern California and especially in the vicinity of Long Beach, 20 miles south of Los Angeles on March 10. Service on the Pacific Electric which runs cars through the streets in the cities affected was obstructed by debris from buildings, but on March 11 all service was restored to normal except into Long Beach proper; and by March 13 the railroad was operating into Long Beach proper. On the Los Angeles Junction Railway, several freight cars were derailed and some property damage occurred, the total damage being estimated at $2,000.

All through trains from Los Angeles scheduled to depart at the time the earthquake occurred left on schedule. During the tremors, railroads in the earthquake territory immediately adopted precautionary measures, such as closing their buildings to the public and sending pilot engines in advance of all passenger trains.

N. & W. Boosts Domestic Stokers for Its Coal

For the second time within the past eighteen months, the Norfolk & Western is distributing literature descriptive of tests which show the efficiency and economy of low and high volatile bituminous coals mined along its line, when used in automatic stokers in domestic heating plants.

The results of the tests, the second series conducted in the road's laboratory in Roanoke, Va., under the supervision of its engineer of tests, are published in an eight-page illustrated booklet, "Fuel Satisfaction and Automatic Stokers". Fifteen thousand copies are now being distributed by the railroad throughout the country to retail coal dealers and consumers of "Fuel Satisfaction"—which the company calls the coal it hauls. A similar booklet giving results of the first series of experiments of this nature, was distributed in September, 1931.

From the second series of tests, made after many requests were received for additional dependable information of this character, there were developed many facts as to the action of these coals in stoker fired plants with relation to the inherent characteristics of the coal, its size, etc.

These experiments were undertaken as part of the railway's program of co-operation with the producers and distributors of coals mined on its line.

World's Fair Party Rates to Meet Auto Competition

Railroads in the Western Passenger Association territory will, on June 1, establish coach party fares to Chicago for parties of from two to five, attending the Century of Progress Exposition, to be held in Chicago during the period of June 1 to November 1, to meet the private automobile situation where the cost of transportation for three, four and five passengers is the same as for one passenger. The party rates are in addition to the special low, round-trip rates for individuals announced previously. Under these new rates, which provide for a return limit of 10 days, the checking of 100 lb. of baggage for each adult and 50 lb. for each child of half-fare age and stopovers at all points on both going and returning trips, three passengers will each be charged one fare for the round trip, four passengers 95 per cent of the one-way fare for the round trip per capita, and five or more passengers 85 per cent of the one-way fare for the round trip per capita. A child of half-fare age will be considered as one passenger in arriving at the minimum number of passengers for the various bases suggested. In case two adults and one child travel, the adults receive the benefit of the one-way fare for the round trip and the child will be charged one-half of the one-way fare for the round trip. Likewise, in the case of three adults and two children the adults will be charged 85 per cent of the one-way fare per capita for the round trip and the children one-half of the per capita rate applicable to the adults.

American and British Trains Side by Side at World's Fair

A train made up of cars taken from trains operated by the Chicago, Burlington & Quincy, the Great Northern, the Northern Pacific, the Colorado & Southern and the Spokane, Portland & Seattle will be exhibited alongside the Royal Scot of the London, Midland & Scottish of Great Britain, at the Century of Progress Exposition which opens in Chicago on June 1. The American and British trains will share the same platform and train shed and will be connected by means of a covered runway so that visitors may pass from the rear of one train into the rear of the other.

The first car of the American train, provided by the Burlington and affiliated lines, will be a U. S. railway post office

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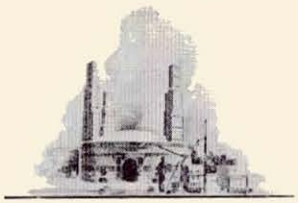


AMERICAN ARCH COMPANY

brought order
out of chaos

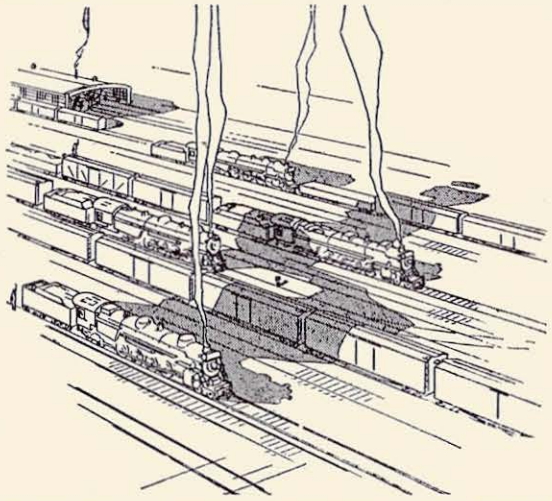
"Go-as-you-please" methods of locomotive Arch design created a serious problem in the early days of Arches.

Every new design of locomotive meant a different tube spacing and a varying size and shape of Arch Brick.

Then, American Arch Company brought order out of chaos. Arch tube spacing was standardized. Arch Brick were standardized. As time went on fewer shapes and sizes were needed to meet any Arch requirements. A serious store problem had been solved.

Even today, American Arch Company is loath to add new brick shapes to complicate the work of the stores department. Its research is rather along the lines of simplification of stocks.

While only one of the many services of the American Arch Company to the railroads, this work has a distinct dollars and cents value.



HARBISON-WALKER REFRACTORIES CO.
Refractory Specialists

AMERICAN ARCH CO.
INCORPORATED
Locomotive Combustion Specialists » » »

car, manned by a crew of postal clerks and demonstrating the methods of sorting, classifying and distributing the mail in a traveling post office. Next will be a chair car of the type carried on the Burlington's Chicago-Denver train, "The Aristocrat," and demonstrating the latest style of adjustable chairs. The third car will be a dining car similar to those used on "The Black Hawk" operating between Chicago and the Twin Cities. Next will be two Pullman cars featuring different types of accommodations and illustrating the equipment carried on the North Coast Limited and "The Empire Builder" between Chicago and Portland, Oregon. The last unit will be a solarium lounge car with appointments suggestive of a town club.

In contrast to this train of 1933, the Burlington will exhibit on an adjoining track a diminutive "Tea Kettle" engine with diamond smoke stack and long cowcatcher, such as was in use in the West in the early 'Eighties. Behind this old engine will be a replica of one of the first railway post office cars operated in the United States, built in 1862 in the railway shops at Hannibal, Mo.

In addition to its train exhibit in the outdoor transportation show, the Burlington and affiliated lines will have another exhibit inside the Travel and Transport building. This exhibit will present in detail large-sized models of four outstanding vacation areas, Rocky Mountain National Park in Colorado, Yellowstone National Park in Wyoming, Glacier National Park in Montana and the Black Hills of South Dakota. These models will be built to scale and will illustrate not only the character and topography of the country—mountains, valleys, canyons, rivers, lakes, waterfalls and other major characteristics—but also a number of other features, such as geysers, hot springs, falls and lakes.

Club Meetings

The Railway Club of Pittsburgh (Pa.) will hold its next meeting at the Fort Pitt Hotel, Pittsburgh, on Thursday evening, March 23. Professor Louis E. Endsley, consulting engineer, will present a paper on springs used in draft gears, past and present.

The Toronto (Ontario) Railway Club will hold its next meeting at the Royal York Hotel, Toronto, on Friday evening, April 7. E. D. Walker, general superintendent of Canadian National Railway electric lines will speak on the application of power in railway traction.

The Eastern Car Foremen's Association will hold its next meeting at the Engineering Societies' Building, West 39th Street, New York City, on Friday evening, April 28. Representatives of the Westinghouse Electric & Manufacturing Company will speak on air conditioning of passenger cars.

The Western Railway Club will hold its next meeting at Hotel Sherman, Chicago, on Monday evening, March 20. F. G. Moody, master car builder, Northern Pacific, will present a paper on car department problems. The Westinghouse Air-brake Company will display motion pictures of the new "AB" freight car brake.

The Indianapolis (Ind.) Car Inspection Association will hold its next meeting on Monday evening, April 3, at the Severin Hotel, Indianapolis. The discussion will be on the A. R. A. Interchange Rules.

The Northwest Car Men's Association (St. Paul) will hold its next meeting at the Y. M. C. A. Gymnasium, Minnesota Transfer, on Monday evening, April 3. Railroad transportation problems will be discussed by Paul Schuneman, president of the Citizens' Transportation League.

The Car Foremen's Association of Chicago will hold its next meeting at the Auditorium Hotel, Chicago, on Monday evening, April 10. The discussion will be on the A. R. A. Standard Wheel Gage and its uses.

Mr. R. R. a Good Citizen

One week ago when the racing floodwaters of Pearl river spread over the lowlands and put hundreds of lives in peril, what was the first agency turned to for relief?

Incidentally, you didn't hear of any passenger bus or commercial freight truck lines carrying people to safety, did you? Railroads regard themselves as citizens in the territory they serve. Furthermore, they strive to be good citizens; willing and eager to perform their full share of all civic duties.

Suppose the railroad held its citizenship as lightly as does the average individual? On this subject suppose we do a little supposing and see where we get.

1. Suppose all railway lines operating in Mississippi should tell the state they are dead broke and cannot pay any taxes this year? As a matter of fact, they are dead broke, and several of them are in the hands of receivers. When they pay taxes, it will be with borrowed money, and just now some of them are wondering where they are going to borrow it.

2. Suppose the railroads, like the state of Mississippi, issued pay warrants to employees that could not be cashed and thus forced them to wait many months for their money?

3. Suppose the railroads, facing payments of interest and principal due on their bond issues, should default or demand postponements? It would make a mighty bleak Christmas for several thousand widows and other small investors in Mississippi who have their money invested in railroad bonds.

4. Suppose the railroads should quit running passenger trains because they are losing money heavily every time a wheel turns under traffic of this class? How would you get to the bedside of a sick wife in a distant state?

5. Suppose the railroads had cut down their staffs of employees in proportion to volume of business handled, as other large corporations have done? How many families would it leave in distress? As a matter of fact, the railroads today could easily handle their traffic with operating staffs 20 per cent smaller than they now have in service.

6. Suppose enforced economy should cause the railroads to refuse further free service and free transportation for the various humane and benevolent institutions in Jackson and other points in the state? Figure out what it would cost to pay for this service? The mounting thousands would surprise you.

7. Suppose the railroads put all of their employees on a commission basis, as many business houses in Jackson have done, paying them only on a basis of the business they actually handle? It would cause a yelp that could be heard to the other end of the world.

8. Suppose the railroads, when presented monthly statements for purchases made, would follow the example of so many citizens and tell the bill collector to come back at four o'clock next fall, or some other time equally remote?

9. Suppose the railroads abandoned all of their agencies for promotion of the material welfare, discharged the men engaged in seeking and locating new industrial interests of the territory they serve, and refuse to co-operate in public movements of any character? At the same time, suppose the railroads became as lawless as the average citizen, ignoring statutes, refusing to obey orders, disregarding traffic rules, and generally comporting themselves as do most folks when the laws don't suit them?

10. Suppose the railroads, emulating a goodly number of non-resident business concerns, shipped their daily cash receipts out of Jackson each night instead of carrying substantial accounts in the various banks?

11. Suppose the railroads, still emulating these non-resident concerns, refuse to give any support to the Chamber of Commerce, an organization in which all of the common carriers here carry a multiplicity of memberships?

12. Suppose the railroad, like the average motor passenger bus line, offered you scanty protection of life and limb when traveling in one of its vehicles, and that you had mighty poor chance of recovering damages in case of accident?

The conclusion is inescapable that the railroads, and especially the kind of railroads we have in Mississippi, are good citizens, and deserve much more kindly consideration at our hands than they ordinarily receive.

—From an editorial in the Jackson (Miss.) News.

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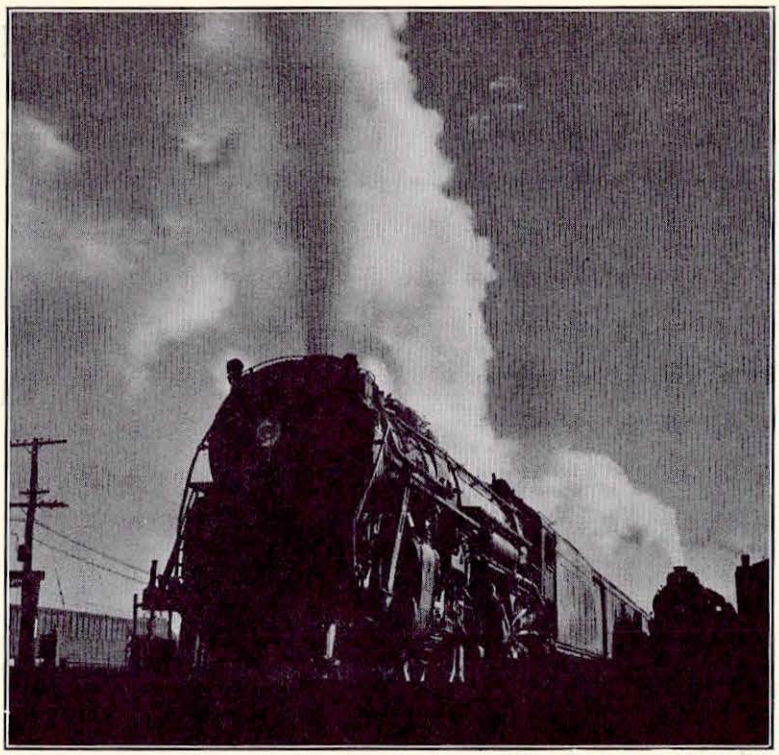

Photo by R. J. Nesmith

Scheduled Trains Have to Move . . .

regardless of conditions . . . . weather, traffic or financial. Whether there are enough loads or passengers, scheduled trains must be run. But it costs just as much to operate a light train—particularly the locomotive—as though it were loaded to capacity.

Why then, isn't it important now, if not more so, to utilize every means for effecting economy that is available? Applying Elesco feed water heaters is a paying proposition in these times. They save fuel that costs you money, and cut operating costs now when so badly needed. They provide that sustained boiler capacity when it is most needed. They pay for themselves as they save for you. Why wait to put them on?

Payment can be arranged on that basis. No capital expenditure, and all gain for you. Ask us about it.

THE SUPERHEATER COMPANY

60 East 42nd Street
NEW YORK

ELESCO

Peoples Gas Building
CHICAGO

Canada: The Superheater Company, Limited, Montreal

A-772

Superheaters - Feed Water Heaters - Exhaust Steam Injectors - Superheated Steam Pyrometers - American Throttles

Supply Trade

Effective February 27, in addition to his other duties, **S. G. Johnson**, assistant to the president of the **General Railway Signal Company**, New York, has taken over the duties of eastern manager, having jurisdiction over the New York and Montreal offices.

Arthur E. Blackwood, president of the **Sullivan Machinery Company,** Chicago, has been elected chairman of the board and will be succeeded by **Henry S. Beal,** formerly general manager of the Jones & Lamson Machine Company, Springfield, Vt.

Howard P. Cook, who has been elected president and treasurer of the **Columbia Nut & Bolt Co., Inc.**, Bridgeport, Conn., has been identified with the sales department of that company for the past 20 years serving as its vice-president since 1922.

Howard P. Cook

Mr. Cook is also president of the Howard P. Cook Company, Bridgeport and Chicago, dealers in railroad supplies since 1924, and vice-president of the Atlantic Manufacturing Company, Milford, Conn., manufacturers of screw machine products.

Westinghouse Electric & Manufacturing Company

The Westinghouse Electric & Manufacturing Company, for the year ending December 31, 1932, reported a net loss of $8,903,540 as compared with a net loss of $3,655,659 in 1931 and a 1930 net income of $11,881,705. Sales billed last year totaled $77,073,586 as compared with $115,393,082 in 1931 and $180,283,579 in 1930.

The balance sheet as of the close of last year lists total current assets of $78,816,115 and total current liabilities of $4,333,692—a ratio of 18.2 to 1. Cash and marketable securities amounted to $32,851,763 as compared with $32,148,727 on December 31, 1931.

The consolidated income and surplus account for the year 1932 is as follows:

Net Sales	$77,073,586
Cost of Sales:	
Manufacturing cost and all distribution, administration and general expenses—including provision for taxes, service annuities, operating reserves, and depreciation of buildings and equipment	86,412,627
Loss from Sales	$9,339,041
Other Charges:	
Current operating loss of subsidiary companies not included in consolidation	$2,184,911
Loss from Operations	$11,523,952
Less Income Credits:	
Interest, discount and miscellaneous income, net	‡$1,713,140
Dividends and interest on investments	1,195,413
Total	$2,908,553
Net Loss before provision for foreign exchange losses	$8,615,399
Provision for decline during the year in valuation of net current assets in foreign countries	288,141
Net Loss for the Year	$8,903,540
Surplus at beginning of year	79,050,324
Surplus before adjustments and dividends	$70,146,784
Adjustments:	
Revaluation of investments in companies not previously consolidated	
Provision for decline in value of securities	$708,141
Adjustment of accounts receivable from Radio Corporation of America	3,575,188
Deposit with Westinghouse Electric Annuity Trust	902,407
Miscellaneous, net	372,162
Total	$5,557,898
Surplus before dividends	$64,588,886
Dividends:	
On preferred capital stock	$279,919
On common capital stock	2,262,170
Total	$2,542,089
Surplus at end of year including $16,293,860.00 capital surplus representing premium on sale of additional common capital stock in 1929	†$62,046,797

Note—Provision for plant and equipment depreciation for all companies included in the foregoing statement, for the year 1932 amounted to $5,274,857.52 and for the year 1931 amounted to $5,173,914.00.

† Since the date of this statement this item has been reduced to the extent of $11,043,341 by the payment to stockholders, on February 20, 1933, of the dividend of one-half share of Radio Corporation of America common stock upon each share of Westinghouse stock.

‡ Includes a profit of $778,887.87 from the sale of Radio Corporation of America stock which was acquired prior to 1930.

The Minister of Transport of Great Britain, in pursuance of powers conferred upon him by Section 16 (2) of the Railways Act of 1921, has recently issued a "standardization of electrification" order. This order follows the advice of the Railway Electrification Committee (1927), and provides that future schemes of electrification of standard-gage railways shall be on the direct-current system, and at a maximum voltage of either 1,500 with overhead collection, or 750 with top contact third-rail collection, subject to the power of the Minister to consent to a maximum voltage of 3,000 with overhead collection under special conditions. Maximum loading gages of electric locomotives are specified in the order and provision is also made for the standardization of methods of collection and third-rail and overhead equipment. Through running of electric locomotives between 1,500-volt and 750-volt systems in the future is dealt with by a provision that when one-third of the steam locomotives of a given railroad have been replaced by electric motors, such electric locomotives as the Minister shall direct shall be equipped with lower voltage motors and series-parallel switching equipment, etc., so as to render them capable of running on both higher and lower voltage systems.

Equipment and Supplies

LOCOMOTIVES

The United States Navy Department, Bureau of Supplies and Accounts, Washington, D. C., is inviting bids, until April 4, for two Diesel-electric switching locomotives of 35-tons capacity. These are for service in Hawaii.

FREIGHT CARS

The American Railway Association has placed an order with the American Railway Car Institute for five sample A. R. A. standard all steel 50-ton box cars of the design adopted by letter ballot in 1932. The cars will be constructed by the Pressed Steel Car Company at its McKees Rocks, Pittsburgh, plant.

IRON AND STEEL

The Chicago, Rock Island & Pacific has ordered 250 tons of structural steel for bridge work in Tarrant County, Tex., from the North Texas Iron & Steel Company.

The Pennsylvania has given a contract to the Phoenix Bridge Company for 150 tons of steel for a bridge to be built over DeKalb street in connection with grade crossing elimination work being carried out at Norristown, Pa.

MISCELLANEOUS

The Chicago, Milwaukee, St. Paul & Pacific on March 13, recalled 850 men to its passenger car shops at Milwaukee, Wis. The shops have started work on a car repair program.

The St. Louis Southwestern has recalled 200 men to work for an indefinite period in the locomotive department of its division shops at Pine Bluff, Ark. The railway now has 600 men employed in these shops.

Construction

Chesapeake & Ohio.—This road has awarded a contract to Haley, Chisholm & Morris, Charlottesville, Va., to enlarge the Little Bend tunnel at Hilldale, W. Va., at a cost of about $349,000. It has also authorized the rebuilding of a portion of bridge No. 11 over Mill creek at Cincinnati, Ohio, at a cost of about $153,500.

St. Louis-San Francisco.—The receivers of this road have been authorized by the United States District Court at St. Louis, Mo., to spend approximately $720,000 for improvements during the first half of the year. This sum will be used principally for laying heavy rail, providing additional ballast and for some bridge work.

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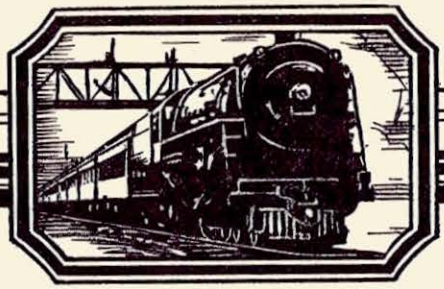


Alco Alco

A Prominent Industrialist Once Said—

"If there is a machine that can effect a given saving in any operation, you are paying a tax equal to the amount of that saving all the while you delay installing that machine."

IT is a matter of record that industrial and public utility plants often replace apparently new machines long before the luster of the paint is tarnished. Why? Simply because they are obsolete and can be replaced by machines of greater capacity and efficiency. That's good business because the loss on obsolete machines costs more than replacement with modern machinery.

Modern locomotives will pay. Experience proves it. A notable example is the 38 per cent return on the twenty new Lehigh Valley locomotives running between the Niagara frontier and Jersey City.

To Economize—Modernize

American Locomotive Company
30 Church Street New York N.Y.

Alco Alco

Financial

BALTIMORE & OHIO.—*Abandonment.*—This company has applied to the Interstate Commerce Commission for authority to abandon operation over the line of the Little Kanawha from Placid station, W. V., to Owensport, 20.98 miles.

CENTRAL WEST VIRGINIA & SOUTHERN.—*Bond Maturity.*—The Interstate Commerce Commission has authorized this company to extend from January 1, 1933, to January 1, 1938, the maturity date of $25,000 of its first mortgage 5 per cent bonds.

GREAT NORTHERN.—*Bonds.*—This company has applied to the Interstate Commerce Commission for authority to reissue $9,141,000 of general mortgage 7 per cent bonds, to be pledged as collateral for short-term notes.

MISSOURI PACIFIC.—*Abandonment.*—This company has applied to the Interstate Commerce Commission for authority to abandon 90.5 miles of branch line from Fort Scott, Kan., to Lomax.

NEW YORK CENTRAL.—*Robert F. Loree, a Director.*—Robert F. Loree has been elected a director of this company succeeding the late Warren S. Hayden.

NEW YORK CENTRAL.—*Abandonment.*—The Interstate Commerce Commission has authorized the Kankakee & Seneca, the Cleveland, Cincinnati, Chicago & St. Louis, and the New York Central to abandon the entire line of the first named company extending from Kankakee, Ill., to Seneca, 42.2 miles. The Secretary of War has ordered the company to change its bridge over the Illinois river to improve navigation on that stream at an expense estimated at $190,400, plus an additional operating expense of $5,000 annually. Owners of elevators and other businesses along the line opposed the application, alleging that the abandonment would injure if not destroy their business. In granting the application the Commission stated: "The people in the tributary territory do not furnish sufficient traffic to support the railroad, and can not expect it to be continued in operation."

NEW YORK, ONTARIO & WESTERN.—*Annual Report.*—The 1932 annual report of this company shows net income of $777,593, an increase of $108,350 over the 1931 figure of $669,243. Selected items from the Income Statement follow:

	1932	Increase or Decrease
Railway Operating Revenues	$10,571,876	−$771,102
Maintenance of way	1,220,911	− 58,006
Maintenance of equipment	1,825,497	− 123,227
Transportation	3,995,992	− 490,504
Total Operating Expenses	7,522,187	− 728,326
Operating ratio	71.15	− 1.59
Net Revenue from Operations	3,049,689	− 42,776
Railway tax accruals	547,394	+ 84,727
Railway operating income	2,501,413	− 126,161
Hire of freight cars—Dr.	$548,998	−$208,635
Net Railway Operating Income	1,860,232	+ 90,878
Non-operating income	466,793	+ 18,289
Total Income	2,327,025	+ 109,168
Rent for leased roads	227,875	
Interest on funded debts	1,217,329	+ 34,566
Total Deductions from Gross Income	1,549,431	+ 818
Net Income	$777,593	+$108,350

NORFOLK & WESTERN.—*Abandonment.*—The Interstate Commerce Commission has authorized this company to abandon a branch line extending from West Jefferson, N. C., to Elkland, 19.4 miles. The line is paralleled by hard-surfaced highways and trucks have largely taken the available traffic. The line has heretofore yielded an average of $9,195 annually in taxes and wages of train and station employees have averaged approximately $25,000 annually.

READING.—*Annual Report.*—The 1932 annual report of this company shows net income after interest and other charges of $4,228,789, compared with net income of $3,314,928 in 1931. Selected items from the income statement follow:

	1932	1931	Increase or Decrease
Railway Operating Revenues	$51,806,374	$70,614,089	−$18,807,715
Maintenance of way	4,270,017	9,194,346	− 4,924,329
Maintenance of equipment	10,676,671	17,031,875	− 6,355,204
Transportation	20,416,988	28,864,489	− 8,447,501
Total Operating Expenses	38,804,169	59,025,460	− 20,221,291
Operating ratio	74.90	83.59	− 8.69
Net Revenue from Operations	13,002,205	11,588,630	+ 1,413,575
Railway tax accruals	1,590,521	2,286,226	− 695,705
Railway operating income	11,404,622	9,300,824	+ 2,103,798
Hire of freight cars—net deb't	545,394	599,620	− 54,226
Joint facility rents—net	160,471	199,893	− 39,422
Net Railway Operating Income	11,086,616	8,994,704	+ 2,091,912
Non-operating income	2,760,705	3,858,433	− 1,097,728
Gross Income	13,847,322	12,853,137	+ 994,185
Rent for leased roads	3,258,886	3,271,861	− 12,975
Interest on funded debt	5,632,112	5,574,743	+ 57,369
Total Deductions from Gross Income	9,618,533	9,538,209	+ 80,324
Net Income	$4,228,789	$3,314,928	+ $913,861

ROCKTON & RION.—*Authority to operate denied.*—The Interstate Commerce Commission has denied the application of this company for authority to acquire and operate a 4-mile line extending from Rockton, S. C. to Rion.

ROWLESBURG & SOUTHERN.—*R. F. C. Loan Denied.*—Upon further consideration Division 4 of the Interstate Commerce Commission has affirmed its previous report denying this company's application for a loan of $150,000 from the Reconstruction Finance Corporation.

ROWLESBURG & SOUTHERN.—*Authority to Acquire Line Denied.*—The Interstate Commerce Commission has denied the application of this company for authority to acquire and operate the Cheat River Railroad, an intrastate carrier, extending from a connection with the applicant's line at Erwin, Va., southerly for about 15 mi.

ST. LOUIS-SAN FRANCISCO.—*R. F. C. Loan.*—The Interstate Commerce Commission on March 13 denied the petition of the receivers for a reconsideration and modification of the report by Division 4 which had approved a loan of $3,000,000 from the Reconstruction Finance Corporation to the receivers on condition that they should secure by receivers' certificates loans which had been made to the railway company prior to the receivership. The receivers, in petitioning for the reconsideration, had stated that they had been advised by their counsel that they could not legally comply with that condition.

TITTABAWASSEE RAILROAD.—*Authority to operate denied.*—The Interstate Commerce Commission has denied the application of this company for authority to acquire and operate 8.54 miles of industry tracks owned by the Dow Chemical Company in Midland county, Mich. The company also asked authority to construct 3.6 miles of line, and this authority has also been denied.

WESTERN MARYLAND.—*Tentative Recapture Report.*—Division 1 of the Interstate Commerce Commission has issued a tentative recapture report finding that this company had excess net railway operating income in 1926 and 1927 amounting to $2,129,789, of which one-half would be recapturable, accompanied by an order directing payment of the amount unless a protest is filed by April 24.

Dividends Declared

Beech Creek.—50c, payable April 1 to holders of record March 15.

Bessemer & Lake Erie.—Common, 1½ per cent, semi-annually, payable April 1 to holders of record March 15.

Canadian Pacific.—Dividend omitted.

Old Colony.—$1.75, quarterly, payable April 1 to holders of record March 18.

St. Joseph, South Bend & Southern.—75c semi-annually; Preferred, $2.50 semi-annually, both payable March 15 to holders of record March 10.

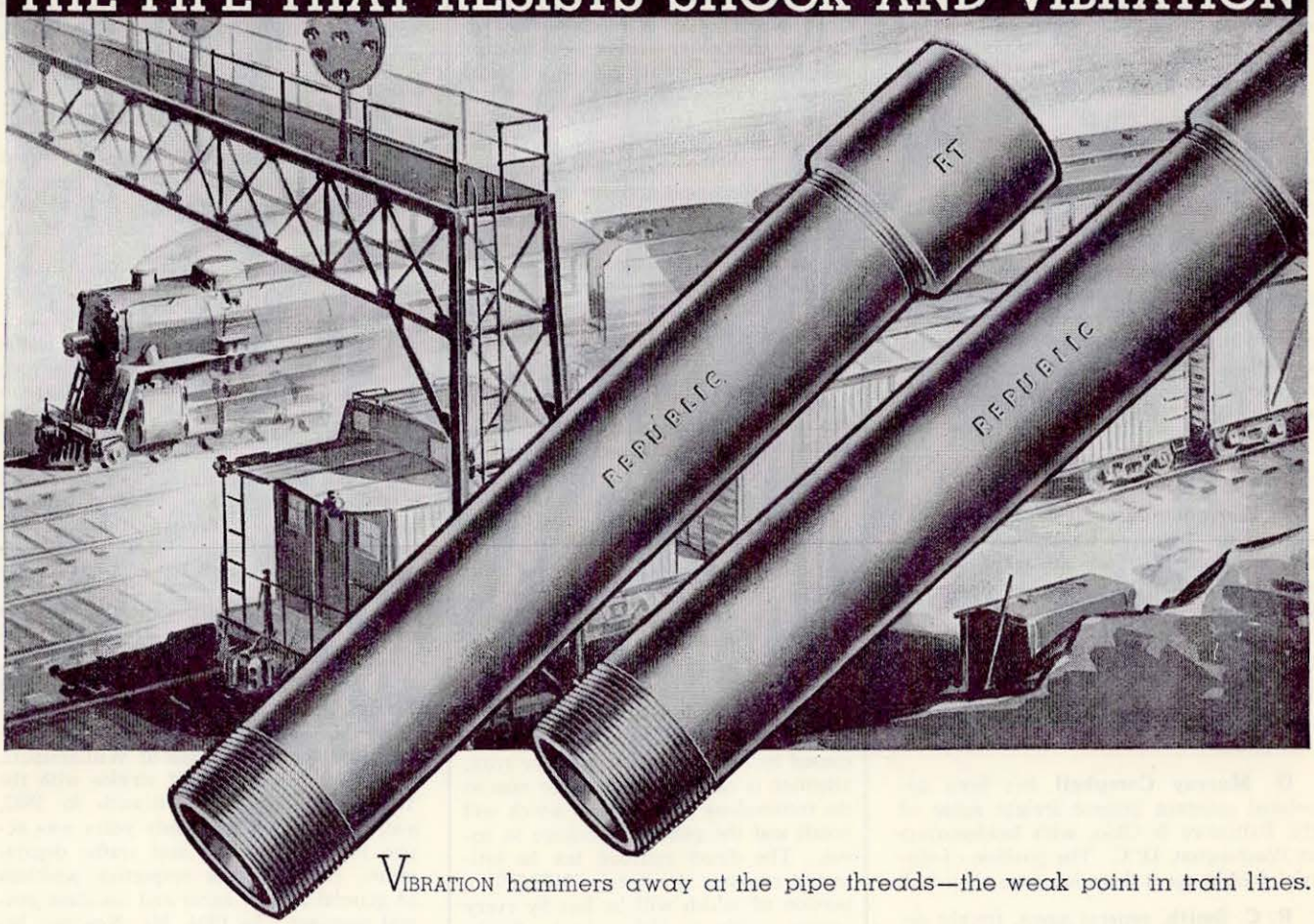
* * *

"Ship by Rail" Emblem Designed by Al Eckblom, Office of General Superintendent, St. Paul Union Depot Company

Continued on next left-hand page

FOR TRAIN LINES TONCAN IRON

THE PIPE THAT RESISTS SHOCK AND VIBRATION



VIBRATION hammers away at the pipe threads—the weak point in train lines.

To be successful in this service a pipe needs toughness, to absorb and distribute localized strains such as occur at the root of a thread, plus corrosion resistance to withstand weakening due to rust and corrosion. « Toncan Iron Pipe has these qualities to a high degree. The toughness of the metal has been proven by its use in staybolts—a far more exacting service. « This alloy of scientifically refined iron, copper and molybdenum has a proved resistance to rust second only to the stainless irons and steels in the ferrous metal group. Moreover, this resistance is uniform throughout the entire thickness of the metal, not confined to the surface. The result is that Toncan Iron Pipe is economical in service throughout its longer, trouble-free life.

REPUBLIC STEEL
CORPORATION
GENERAL OFFICES YOUNGSTOWN, OHIO

TONCAN
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IRON PIPE

Railway Officers

EXECUTIVE

S. K. Simmons, industrial and land commissioner of the Kansas City, Mexico & Orient, has been elected vice-president and treasurer, with headquarters as before at Los Mochis, Sin., Mex.

George S. Ross, secretary and assistant vice-president, traffic, of the New York, Chicago & St. Louis, with headquarters at Cleveland, Ohio, has resigned the latter position to devote his entire time to the duties of secretary. The position of assistant vice-president, traffic, has been abolished.

Dana C. Douglass, vice-president and general manager of the Maine Central, has been appointed executive vice-president, with headquarters at Portland, Me., as before. He will assume supervision of all operating activities including traffic and accounting.

TRAFFIC

F. E. Anderson, assistant to the president of the Terminal Railroad Association of St. Louis, has been appointed general passenger and ticket agent, succeeding **A. C. Barnett.**

Charles J. Seel, commercial agent for the Chicago & Illinois Midland at Des Moines, Iowa, has been appointed to the newly-created position of general agent at that point.

G. Murray Campbell has been appointed assistant general freight agent of the Baltimore & Ohio, with headquarters at Washington, D. C. The position of district freight agent there has been abolished.

R. C. Smith, general agent, freight department, for the Atchison, Topeka & Santa Fe, at Detroit, Mich., has been appointed also general agent, passenger department, succeeding **F. T. Hendry,** deceased.

OPERATING

V. H. Wilson, acting superintendent of the Albuquerque division of the Atchison, Topeka & Santa Fe, with headquarters at Winslow, Ariz., has been appointed superintendent of the same division.

S. S. Sprague, supervisor of train schedules on the Southern Pacific, Pacific Lines, has been appointed passenger car service agent, with headquarters as before at San Francisco, Cal., succeeding **J. G. F. Moale,** deceased. **P. S. Cunningham** has been appointed supervisor of train schedules to succeed Mr. Sprague.

A. E. Jacoby, trainmaster on the Chicago terminal division of the Pennsylvania, has been transferred to the Grand Rapids division, with headquarters at Grand Rapids, Mich., to succeed **F. H. Wisegarner,** who has been transferred to the Indianapolis division, with headquarters at Indianapolis, Ind. Mr. Wisegarner replaces **C. P. Fisher,** who has been transferred to the Chicago terminal division at Chicago to succeed Mr. Jacoby.

H. J. Klein, vice-president in charge of operation and maintenance of the New York, Chicago & St. Louis, with headquarters at Cleveland, Ohio, has been appointed general superintendent of transportation of the Chesapeake & Ohio with headquarters at Richmond, Va., succeeding **A. T. Lowmaster,** whose promotion to general manager was noted in the *Railway Age* of February 25. **Richard Brooke,** engineering assistant to the president of the Chesapeake & Ohio and the Pere Marquette, with headquarters at Cleveland, Ohio, has been appointed to the newly-created position of assistant general manager of the C. & O., with headquarters at Richmond.

PURCHASES AND STORES

H. K. T. Sherwood, industrial agent of the Delaware & Hudson, has been appointed purchasing agent with headquarters at Albany, N. Y., succeeding **H. A. Empie,** deceased.

OBITUARY

Ernest F. Randall, assistant traffic manager of the Litchfield & Madison, with headquarters at St. Louis, Mo., died on March 5 at his home at that place of a cerebral hemorrhage.

J. H. Brown, traffic and industrial manager of the Belt Railway of Chicago and the Chicago & Western Indiana, with headquarters at Chicago, died suddenly on March 6 at Chicago.

Peter M. Newman, formerly president of the Susquehanna & New York, the Tionesta Valley, and the Clarion River, who died on February 15, at his home at Pennsdale, Pa., was born near Hughesville, Pa., on June 3, 1861, and was educated in the public schools of Williamsport, Pa. He entered railroad service with the Williamsport & North Branch in 1883, and for a period of twenty years was active in the operating and traffic departments, rising to the respective positions of general freight agent and assistant general manager. In 1904, Mr. Newman became connected with the Susquehanna & New York as general manager, and later he was elected president of that road and also of the Tionesta Valley and the Clarion River railways.

E. E. Young, formerly a general superintendent on the Chicago, Burlington & Quincy at Alliance, Neb., died on March 8 at Chicago, following a long illness. Mr. Young was born on November 7, 1859, in Illinois and entered railway service on November 8, 1879, as a brakeman on the Burlington. He served in various positions in the operating department until April, 1906, when he was appointed trainmaster at Lincoln, Neb., being transferred to Denver, Colo., in December of the same year. In 1907 Mr. Young was promoted to superintendent at McCook, Neb., where he remained until November, 1908, when he was transferred to Sheridan, Wyo. He was promoted to general superintendent at Alliance, in February, 1910, remaining there until April, 1918, when he was again appointed superintendent at McCook. Two years later Mr. Young resigned because of ill health and for a time engaged in other business.

Abandoning a Railroad

Although not unexpected, the action of the Interstate Commerce Commission, Wednesday, in making a final order permitting the Chicago, St. Paul, Minneapolis & Omaha to abandon its line from Wynot to Coburn in Northeastern Nebraska, means a ruinous blow at one of the oldest sections of the state and what was formerly one of the most prosperous. It happens that news of this action upon the part of the national regulatory body came on the same day that the Lincoln Star received from a resident of Wynot a letter pointing out some of the reasons for the abandonment as well as some of the certain results.

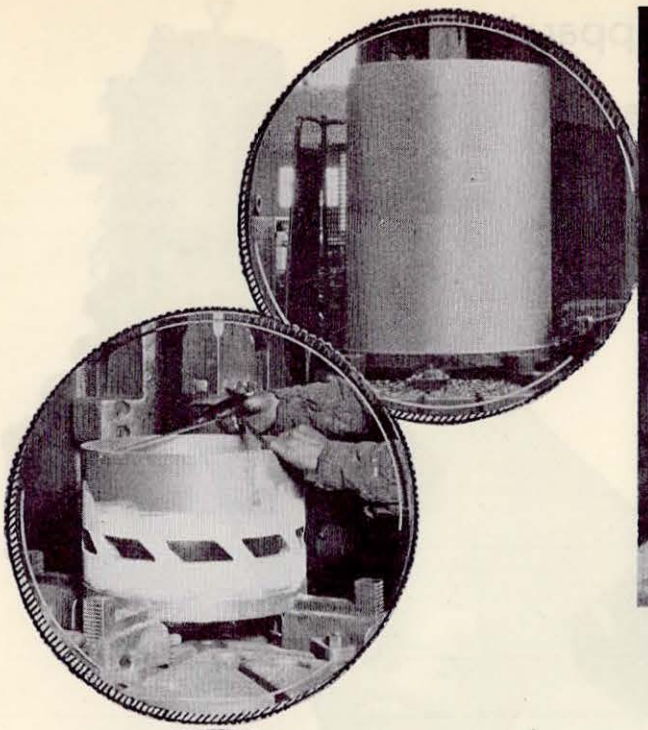
The principal reason that the 60-mile railroad has ceased to be profitable, according to the Wynot correspondent, is that commercial truckers have taken away the greater part of the traffic which formerly moved over the line, and it is insisted by him that the competition of these truckers has been unfair. This is because they have done hauling at prices which would not enable them to pay on their equipment and put aside sinking funds for depreciation and replacement.

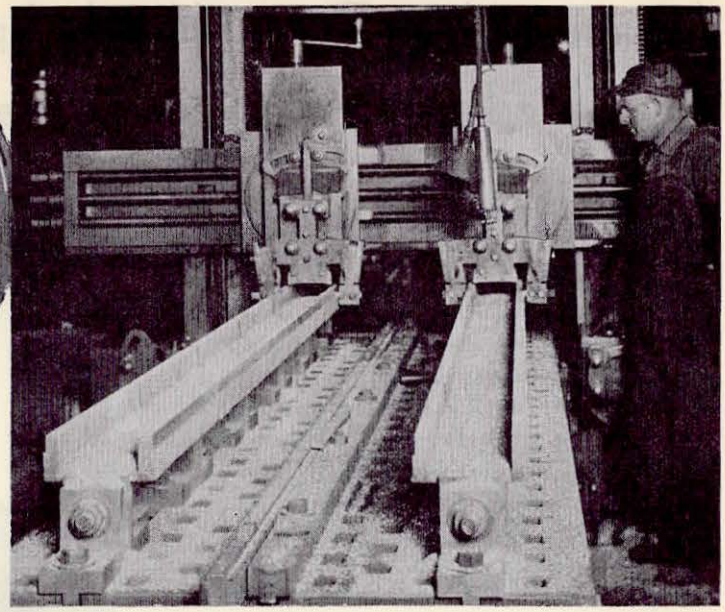
But aside from the inconvenience caused by the abandonment of the road, attention is called by the Wynot man to the tremendous loss of taxes which will result and the general wreckage to ensue. The direct railroad tax he estimates amounts to nearly $100,000, a portion of which will be lost by every county, village and school district through which the road passes. Necessarily, grain elevators, lumber and coal yards will be abandoned, and people will be required to haul their products greater distances to market, as well as to truck in their supplies. Then there will be further tax losses on lumber, coal and other stocks.

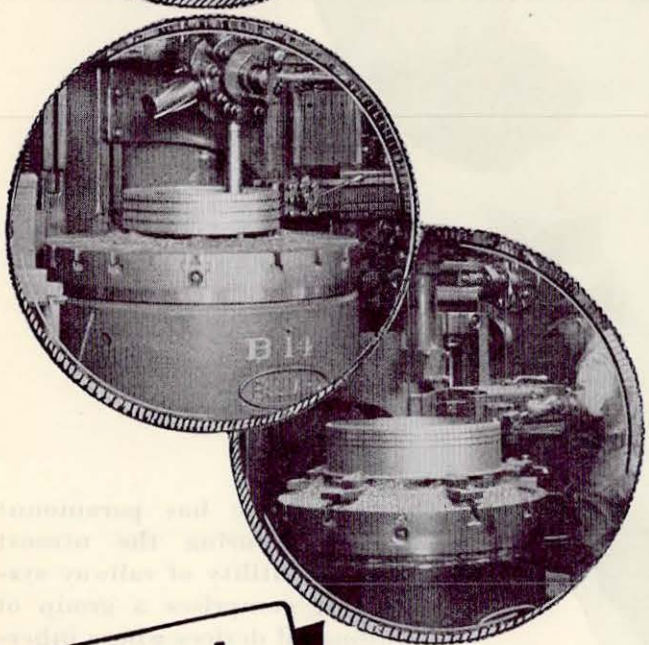
As a natural result realty and other values in towns and villages will decrease, thus enhancing the tax burden on other classes of property. It is a sad prospect, but it should occasion no surprise. People want the railroads when they see them vanishing, but apparently fail to appreciate them until their abandonment is threatened. Those on the Wynot line may have made some saving through the patronage of commercial trucks, but it seems inevitable that this will be far more than offset through additional taxes and greater cost as the result of longer hauls on lumber, coal and other commodities. It was a wise man who said that you can't eat your cake and keep it.

An editorial from the Lincoln (Neb.) Star

Report of A. R. E. A. Convention begins on second right-hand page.







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This feature insures a big saving in machining costs — less stock has to be removed — less time is required for each part, and there is less waste of material.

And, operators can safely run their machines at maximum speeds without any danger of breaking the cutting tools. These economies in machining are a good start in your maintenance program.

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Careful selection and skillful breeding produce thoroughbred stock. Cross-breeding eventually results in degeneration . . . Present-day railway equipment has attained its high standard through years of consistent development and skillful manufacture by specialists. Its intended usefulness is maintained by continued use of genuine parts.

The Air Brake has paramount value in assuring the utmost safety and utility of railway systems. It comprises a group of co-ordinated devices whose inherent effectiveness can be adequately maintained only by using "pedigreed" maintenance parts—those that are made in the "Home of the Air Brake."

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To secure the best results from Westinghouse compressors, secure Westinghouse replacement parts.

(1229)

Railway Engineers Meet at Chicago

Report of the annual convention of the American Railway Engineering Association held on March 14 and 15.

A pictorial review of current developments in the field of appliances and materials used in railway construction, maintenance and signaling.

Advertisements of manufacturers who would normally have participated in the annual exhibit of the N. R. A. A. if it had been held.

A.R.E.A. Holds Another Convention at Chicago

J. V. Neubert
President

Two-day meeting at Palmer House was highly successful in spite of restriction on attendance resulting from bank holiday

W. P. Wiltsee
President-Elect

THE thirty-fourth annual convention of the American Railway Engineering Association was held at the Palmer House, Chicago, on Tuesday and Wednesday of this week. This association is one of the few organizations of railway officers that has never failed to hold its annual meetings since its organization in 1900, but this year, as in 1932, the convention was limited to two days. An evening session on Tuesday was devoted to the presentation of reports of the committees on Rail and on Stresses in Track, the former being featured by an informal talk by Prof. H. F. Moore of the University of Illinois, who is in charge of the Joint Rail Investigation, and the latter by an illustrated lecture by the chairman, A. N. Talbot, also of the University of Illinois. In lieu of a banquet, a luncheon was given on Wednesday for 500 members of the A. R. E. A. and the National Railway Appliances Association and their guests, at which F. E. Williamson, president of the New York Central, spoke. Mr. Williamson addressed his remarks in particular to the need for a study of the fundamental principles of railway transportation for the purpose of ascertaining how the existing plant can be made to meet changing needs. The principal main lines, he said, will undoubtedly continue to function as channels of general transport, but the branch lines present a problem of an entirely different nature which must be solved while avoiding excessive additional capital obligations. The registration showed an attendance of 395 members and 209 guests, an attendance only 20 per cent below that of last year.

President Neubert Proposes Changes

In his address at the opening of the convention, President John V. Neubert, chief engineer maintenance of way of the New York Central, stressed the importance of the work of the association and reviewed briefly a report made to R. H. Aishton, president of the American Railway Association, on the field for the continued usefulness of the A. R. E. A.

After directing attention to the changes in the status of railway transportation from a virtual monopoly to that of an agency confronted with active and subsidized competition, he expressed the opinion that the association should be prepared to make such changes in organization as are necessary to realize the maximum effectiveness and proposed the consolidation of the committees on Roadway and Ballast; Ties and Wood Preservation; Wooden Bridges and Trestles with Iron and Steel Structures; and Records and Accounts with Uniform General Contract Forms. He suggested also that the Committee on Buildings handle subjects related to enginehouses and locomotive terminal buildings, now under the jurisdiction of the Committee on Yards and Terminals; and either a broadening of the work of the Committee on Standardization, or the organization of another committee to serve as a clearing house for the findings of the various groups.

The report of Secretary E. H. Fritch showed a total membership of 2,311, compared with 2,753 in March, 1932. The financial statement revealed an excess of receipts over disbursements during 1932 of $4,956.31.

Uniform General Contract Forms

F. L. Nicholson, Chairman*

The report of the committee this year was largely one of progress, without detailed information. The committee pointed out that the forms which it now has under consideration are of such a nature as to require collaboration with other committees of the association and, in addition, conferences and correspondence with other organizations having to do with the use of such forms, with the view to reconciling, as nearly as possible, the differences of opinion and interest of those concerned.

The only form of agreement presented for consideration was one covering pipe line crossings under railway tracks and the use of railway property by pipe lines generally paralleling the railway. This single form, covering as it does two classes of pipe installations, was developed in spite of the feeling at first that two separate forms of agreement would be required to cover adequately the situations presented.

J. S. Lille (G. T. W.), who presented the form, said that in discussing it with representatives of the Petroleum Institute, it developed that some of them preferred to negotiate with the railways individually, rather than on the basis of a uniform contract. In response to an objection from the floor to conferring with representatives of other organizations, Chairman Nicholson stated

*Chief Engineer, Norfolk Southern.

that no form had ever been discussed with outside organizations until it had been presented to the association for its information and criticism. W. A. Radspinner (C. & O.) suggested a provision for limiting the maximum pressures in the pipe lines to be covered by the contract.

The committee announced that, as a result of submitting last year a tentative form of agreement for the purchase of electrical energy in large volume, it had received a number of constructive criticisms and suggestions. It stated that a complete summary of these criticisms and suggestions is now being considered by the committee and by members of the Electrical Section, with the idea of forming the basis for final revision of the proposed form.

The committee stated that it had prepared a draft of a form of conveyance of title granting the right to construct and maintain air right buildings over railway property, and that this form is now under discussion. It stated further that revision of the subject-matter in the Manual has been given serious consideration, and that studies are being made with the hope of being able to abbreviate and standardize phraseology so that paragraphs covering the same requirements may be used in all forms.

Relative to the form of agreement with public authorities for highway grade crossing elimination or separation, the committee reported that this subject is requiring the most careful consideration and investigation on its part. It promised that the information which it and the Committee on Grade Crossings have gathered will be of valuable assistance to the members of the association.

Wooden Bridges and Trestles

H. Austill, Chairman*

In a relatively brief report, the committee gave greatest attention to improved methods of strengthening existing bridges; the results of its tests to determine the most favorable relationship between the energy of the pile driver hammer and the weight or mass of the pile for proper pile driving; and to revisions of the Manual.

Strengthening Existing Bridges—Viewing this subject from the standpoint of wooden trestles and of methods of actually strengthening structures and not merely carrying out ordinary repairs, the committee offered as information a number of definite suggestions, the more important of which follow:

The strengthening of old structures should be done in a manner to bring them as nearly as possible to the established standard for the district in question.

Standard materials must be used to the fullest extent possible to avoid the necessity of carrying special sizes for repairs.

In general, treated and untreated materials must not be mixed in the same structure.

Any additional piles or posts placed in a bent should be placed as closely as possible under the rails.

When additional stringers are necessary, the old stringers must be loosened and respaced so that the stringers as a unit are symmetrical about the center line of the rail. New stringers must be bolted to the old stringers.

The cross bracing must be changed so that it can be fastened to the new members of the bent.

Any bolt holes left in treated material must be swabbed with hot creosote oil and filled with treated plugs. Any cut surfaces in treated material must be painted with hot creosote oil.

Where strengthening is due to causes other than design, different methods are required. A frequent source of trouble is the lack of proper bearing power of piles. This condition may be remedied, in some cases, by posts on sills, but this is a makeshift and is to be considered only as a temporary arrangement.

Where waterway conditions permit, helper bents will strengthen both the bents and stringers and can generally be so spaced as to become part of a replacement structure.

Trestles which must be raised to have three or more caps should have outside batter piles driven in line with each bent, and the top cap should be made long enough to reach the tops of these batter piles. These piles serve to stiffen the trestle both laterally and longitudinally. The bracing must be changed so as to be attached to all caps.

When additional piles in the line of the bent are required to carry the load, double caps must be used, where necessary, to distribute the load.

Pile Driving—The committee continued its study of the best relationship between the energy of the pile driving hammer and the weight or mass of the pile for proper driving, and presented as Exhibit B of its report (not included here) the results of tests conducted on the Missouri Pacific, in which different sizes and types of piles and different weights of driving hammers were used. It was pointed out that the results of the tests bear out the results of similar tests conducted in 1912, to the effect that the commonly used Engineering News formula does not always provide a very large factor of safety.

Revision of Manual—The committee recommended a number of changes in the Manual, including revision of the present definition for screw pile; changes in the limiting dimensions for Southern pine and Douglas fir piles; and a more comprehensive statement relative to the allowable working stresses permissible in treated timber. Changes were also recommended in the present specifications for structural wood joists, planks, beams, stringers and posts, and in the existing examples of the association's coded specifications for structural grades.

Other Subjects—The committee presented brief reports on the following subjects, which were submitted as information: Simplification of grading rules and classification of timber; overhead wooden or combination wooden and steel highway bridges; and the relative merits of concrete and treated wooden trestles. It reported progress on the following subjects: Design of standard wooden trestles for heavy loadings; bearing power of wooden piles; improved design of timber structures; and design of washers, separators, cap-stringer straps and other trestle fastenings.

*Bridge Engineer, Mobile & Ohio.

Iron and Steel Structures

A. R. Wilson, Chairman*

The committee presented reports on four subjects, as referred to in the following:

Fusion Welding and Gas Cutting—In its study of fusion welding and gas cutting, the committee has been working to the end of establishing practice in design, workmanship and inspection of fusion welding and gas cutting as applicable to bridge and building construction and repairs. During the last year it prepared tentative specifications for fusion welding and gas cutting for steel structures, which it presented to the association with the recommendation that they be received as information. These specifications, which were prepared after a study of the various publications of the American Welding Society, were drawn up under the following main heads: General application, nomenclature, definitions and symbols; materials, permissible unit stresses; design; qualifications of welders; workmanship; protection of steel; erection; gas cutting; and inspection.

Repainting of Steel Bridges—Considering this subject with special reference to the conditions requiring painting, and economical methods of doing the work, the report of the committee dealt essentially with the conditions which make repainting necessary or desirable, the causes of deterioration of the paint film, and economical methods of repainting. As a result of its studies the committee offered the following conclusions:

Albert Reichmann (Am. Br. Co.) submitted these specifications. B. R. Leffler (N. Y. C.) called attention to the fact that the specifications were not presented with the expectation that fusion welding will entirely replace riveted connections in railway bridges, but are intended primarily to cover repair work and strengthening of bridges.

(1) It is better practice and more economical to do spot painting or complete repainting during the incipient stages of corrosion, rather than to defer such work until corrosion has reached an advanced stage.

(2) It is important that the surfaces to be repainted be thoroughly clean and dry, and that the weather and atmospheric conditions be favorable.

(3) Only paints of good quality, thoroughly mixed, should be used.

Bronzes for Iron and Steel Structures—As its report this year, the committee presented a report on The Coefficient of Friction of Bearing Metals for Bridge Seats, prepared in 1932, by R. P. Davis and G. P. Boomsliter, of West Virginia University. This report, which was given in detail with comprehensive tables and charts, covered a series of tests designed to determine the coefficient of friction between various combinations of bronzes and steels. The conclusions arrived at as a result of the tests were given as follows:

(1) The coefficient of friction is independent of the normal pressure.

(2) The range in coefficients expressed in terms of the average of pressure intensities varying from 500 to 20,000 lb. per sq. in., is from about 0.10 to 0.245, 85 per cent of the values being within the limits of 0.12 and 0.165.

(3) Machined surfaces give as low coefficients as rolled planished surfaces.

* Engineer of Bridges and Buildings, Pennsylvania.

(4) Grinding the surface of rolled steel plates when mill scale is present materially reduces the coefficient of friction.

(5) The average coefficient of bronze on steel was 0.146, which was also the value of the average of all tests. The general average of steel on steel was 0.181.

(6) The coefficient of friction, as determined by the use of inclined planes, is materially higher than that found by the pressure method.

Track Anchorage Over Bridges—After discussing the problems encountered in anchoring track rails on bridges and the difference of opinion prevailing on this subject, the committee expressed the opinion that there are not now available adequate data on the longitudinal forces which cause the creeping of rails to warrant a definite recommendation with respect to the anchoring of rails on bridges, and that such data could be obtained only through costly and protracted research. It did, however, present a number of brief conclusions with respect to anchoring rails on open-deck bridges not involving movable spans, which it recommended for adoption. These follow:

(1) Bridges are designed to resist only such longitudinal forces as are imposed within the length of the structure. The magnitude of the forces that cause rails to creep is unknown and may be transmitted from rail to rail for appreciable distances. Consequently the anchoring of rail on a bridge may impose longitudinal forces to the structure for which no adequate provision has been made in the design.

(2) The first step in overcoming the creeping of rails on a bridge is to anchor the rails effectively on the adjacent roadbed.

(3) With adequate anchorage of rails on the adjacent roadbed, there should be no need for any anchorage of rails on short bridges.

(4) If rails on a bridge creep in spite of effective anchoring of the rails on the adjacent roadbed, the anchoring of the rails to the bridge will prove satisfactory and effective in many cases, but such anchoring must be undertaken only when the movement of rails on the bridge is not the result of uncontrolled creeping on the adjacent roadbed.

(5) If inability to control excessive creeping of the rails on the adjacent roadbed produces objectionable movement of the rails on the bridge, it may be necessary to guard against the effect of creeping rail on the adjacent roadbed by introducing adequately guarded switch points at each end of the bridge, anchoring the rails on the bridge if necessary, and allowing the rail on the adjacent embankments to run.

(6) If inability to control excessive creeping of the rails on the bridge, in spite of effective anchorage of the rails on the adjacent embankments, produces objectionable movement of the rails on the bridge, it may be necessary to introduce adequately guarded switch points at each end of the bridge to take care of such creeping.

(7) In these cases where the rails are anchored on the bridges:

(a) Rail anchors of demonstrated effectiveness on roadway track will generally be found effective on bridges.

(b) Rail anchors should be applied to ties that are effectively secured against longitudinal movement relative to the bridge members on which they are supported.

(c) Anchors applied to rails on a bridge should be so located relative to the expansion bearings of the spans, or slip joint, as to permit the proper movement of the rails relative to the structure.

(d) The number of anchors applied and their distribution along the structure will depend on the severity of the creeping action, its direction and whether or not it is necessary to resist movement in more than one direction.

Subcommittee Chairman W. S. Lacher (*Railway Age*) presented this report, and the conclusions were adopted for publication in the Manual, with some minor revisions of this wording.

Report on Electricity

W. M. Vandersluis, Chairman*

The assignment of the Committee on Electricity calls for keeping the association informed as to the current activities of the Electrical section, A.R.A. Accordingly, therefore, the committee called attention to the detailed reports prepared by the several committees of the Electrical section during the year and acted on at the annual session of the section held in Chicago on October 27, 1932. It pointed out that these reports were reprinted in full in Bulletin 348, August, 1932. The reports covered the following subjects: Revision of Manual, inductive co-ordination, power supply, electrolysis, co-operation in miscellaneous regulations, overhead transmission line and catenary construction, economics of electric operation, standardization of insulating tape, standardization of insulators, protection of oil sidings, specifications for track and third-rail bonds, illumination, design of indoor and outdoor substations, high tension cables, application of corrosion-resisting materials to railroad electrical construction, form of power contract for large blocks of power, and radio antennae on cars in electrified territory.

* General Superintendent Telegraph & Signals, Illinois Central System.

Signals and Interlocking

P. M. Gault, Chairman*

The committee presented reports on six specific assignments and advised that, as instructed, it had collaborated with the Committee on Grade Crossings in a study of automatic highway crossing protection, and with the Committee on Clearances in furnishing it information pertaining to signals and interlocking.

Developments in Automatic Train Control—The committee advised that the total mileage of automatic train control has been reduced. It advised further that nothing new has been developed in the matter of interchangeability.

Report was made relative to approval by the I. C. C. of petitions by the Northern Pacific and the Great Northern and others for relief from maintaining and operating automatic train control installations, and of petitions by the Union Pacific and the Pennsylvania to be permitted to operate locomotives equipped with automatic cab signals in lieu of automatic train control devices. It was stated that five other roads, the Chicago, Burlington & Quincy, the Texas & Pacific, the Missouri Pacific, the Chicago, Rock Island and Pacific, and the Delaware & Hudson, had filed petitions with the Commission for relief from maintaining automatic train control.

Chairman Gault explained that in the report concerning centralized traffic control on the Missouri Pacific, Table II had inadvertently been omitted from the bulletin but would be included in the proceedings.

Signal Indications in Lieu of Train Orders and Timetable Superiorities—At last year's meeting, a report, illustrated with lantern slides, was presented relating to the centralized traffic control installations on the Missouri Pacific and the Pennsylvania. The report of the committee this year relates to the economic results of the Missouri Pacific installation, which embraces 43 miles of single track on the Omaha division between Kansas City (Edgewater junction), and Atchison, Kan. According to the report, the cost of this installation, including track changes, was $430,000, and the net saving per annum is $63,349, plus the fact that double-tracking has been postponed. In summarizing its report of the CTC installation on the Missouri Pacific, the committee made the following statements:

Gross tons per train increased 6 per cent. Train miles per train hour (speed) increased 47 per cent. Gross ton-miles per train hour increased 57 per cent. Cost per 1,000 gross ton-miles decreased 39 per cent. Locomotive tractive effort 72,300 lb., no change. Net return on total investment 14.7 per cent. This installation, judged by the improvement in freight train performance and the decreased freight train costs, may be regarded as a self-liquidating project.

Reducing Costs of Construction and Maintenance of Signals and Interlocking—Following a discussion of some of the factors which have made necessary increased expenditures for the construction and operation of signals and interlockings, and of means of minimizing these expenditures without sacrificing suitable protection, the committee presented the following recommendations:

To lower the cost of construction—Determine minimum requirements and have all interested departments approve the plan of the track layout; adopt a universal switch layout; standardize signaling material; use power tools where practicable; use unskilled labor for unskilled work; use modern material; use apparatus of lower standard of excellence where safety is not involved; and omit derails.

To lower cost of maintenance—Build soundly and solidly; employ ample supervision; reclaim materials that may be reclaimed at less cost than new; omit reports where practicable; and omit derails.

In answer to an inquiry from the floor as to whether the committee recommended the omission of derails at all points, Chairman Gault stated that the recommendation was "Derails should not be used in main tracks. . . . ."

Flashing Lights in Railway Signals—The committee canvassed a selected list of 30 roads relative to the use of flashing lights, and from 27 of the roads which made reply, it learned that only three of them are now using flashing lights to govern or control the movement or operation of trains. Following brief reference

* Signal Engineer, Missouri Pacific.

to the particular use on these roads, the committee said in conclusion, that it feels that the restricted use of flashing signals under special rules or instructions is permissible at selected points.

Revision of Manual—The committee recommended the voiding of all Signal Section, A.R.A., matters now in the A.R.E.A. Manual and supplements, and the printing in the next supplement to the Manual of a complete index to the Signal Section manual, as furnished by the secretary of the Signal Section. It recommended further, that notice of changes be made only each year in future supplements to the A.R.E.A. Manual, and that the complete current index be printed only when the A.R.E.A. Manual as a whole is revised.

Current Activities of Signal Section—The report included a list of the investigations which the Signal Section, A.R.A., has made and reported on, from March to November, 1932; also lists of the specifications that have been revised during the year and of new specifications that have been prepared. The report also included, in list form, recommendations for revised requisites, and specifications and requisites to be removed from the Manual.

Shops and Locomotive Terminals

L. P. Kimball, Chairman*

Three subjects were reported on in detail by the committee, and progress was reported in its study of four other assignments.

Firing-Up Stations for Locomotives—The report on this subject, which was illustrated with views of different types of installations, included a definition of a "firing-up" station, and comments relative to the location and types of such stations.

Turntables—Following a general discussion of the different types and functions of turntables, the committee offered 10 conclusions, which it recommended be substituted for the matter now in the Manual under the subhead "Turntable" and "Turntable Pit." These conclusions follow:

(1) Use of a three-point turntable is preferable where long locomotives are to be handled. If a balanced type table is used, it should be long enough to balance the locomotive when the tender is empty.

(2) A deck turntable is usually more economical, but in the balanced type a through table may be desirable where use of a deck structure would greatly increase the cost or make satisfactory drainage difficult.

(3) Where modern heavy locomotives are to be turned, mechanical power for operating turntables should be provided. Where current is available, electricity is the most reliable means of operating a turntable. The power wires should be led to the table underground and be so arranged as to minimize danger of interruption of supply in case of fire in the engine house or other emergency. Where electric power is not available, a compressed air motor may be used.

(4) The deck of the turntable should be wide enough to provide a walk on each side, which should be protected with handrails.

(5) The turntable pit should be paved and adequately drained.

(6) The circle wall should preferably be of masonry, with proper supports and fastenings for rails on the coping. A timber or steel coping is preferable to a rigid masonry coping.

(7) The circle rail should preferably be supported on a concrete base with its load properly distributed to the concrete by ties, plates, or castings.

(8) Easy access to the parts of a turntable for the oiling of bearings, painting and inspection should be provided in the design of the pit, unless ample provision is made in the turntable itself.

(9) Thorough lubrication, systematic cleaning of both table and pit, and careful inspection at regular intervals are essential to satisfactory operation of a turntable. The table should be raised and the center thoroughly inspected at least once a year.

(10) Radial tracks should be kept in good line and surface. Radial track and turntable rails should be maintained with proper spacing between their ends and at their proper relative elevation.

That part of the report relating to turntables was presented by Subcommittee Chairman J. M. Metcalf (M-K-T). After extended discussion, the conclusions were adopted for publication in the Manual, except conclusion No. 3 which was referred back to the committee for further study with reference especially to the determination of the relative merits of underground and overhead power connections.

Unit Heaters—Dealing with this subject from the standpoint of the application of unit heaters to shops and locomotive terminals, the committee first discussed early methods of heating such buildings, and then presented a detailed discussion of the unit heater method. This latter discussion was presented under the headings of description; types; selection of heating system; size and selection of unit heaters; location in shop buildings; unit heaters for engine houses; automatic control; and quietness of operation.

Other Subjects—Progress was reported on revision of the Manual; welding equipment installations as applied to shops and locomotive terminals; wheel removing equipment for engine houses; and car wheel shops.

* Engineer of Buildings, Baltimore & Ohio.

Records and Accounts

C. C. Haire, Chairman*

The work of the committee was handled in six groups, A to F, inclusive, covering miscellaneous matters, general railway engineering reports and records, maintenance of way reports and records, valuation, and accounting practices affecting railway engineering. The various specific subjects given consideration are abstracted in the following:

Drawings and Drafting Room Practice—The major work on this subject was the revision of the present graphical symbols appearing in the Manual. In carrying out the work the subject was divided into two parts: (A) Engineering symbols and office practice, and (B) electrical symbols and office practice, (a) general, (b) signal. The first group was considered this year and the committee presented its recommendations as Exhibit I, consisting of 19 sheets, which cover 35 specific subjects and include a total of 500 symbols.

Joint Facilities—In its first year's study of this subject, the committee gave major consideration to the various ways of determining the rental base from which rentals for the use of joint facilities are computed, and to the various methods used in keeping the rental base up-to-date. No recommendations were made by the committee but it said that the studies made thus far indicate the special need of some simple method of keeping the rental base up-to-date due to changes in facilities, and also for some system of forms or records to be placed in the hands of those responsible for the maintenance and operation of joint facilities in order that they may perform in accordance with the agreement.

Statistical Requirements—Under the subject of statistical requirements of the operating, accounting and other departments with respect to maintenance of way and structures, the committee undertook the preparation of a daily report covering work equipment in service. The report presented, is intended to include special purpose rolling equipment assigned regularly to the maintenance of way and structures department, and all special machines and labor-saving devices. As a result of its study, the committee reported that there appears to be a lack of such reports on most roads and that those that are available differ greatly.

Reports and Records to Budget and Control M. W. Expenses—As its reports on this subject, the committee merely presented an outline of the principal reports required.

Forms Used by Water Service Department—Continuing its work of the last two years, the committee presented two new forms for use by the water service department, one being designed for reporting treating plant operation, and the other for establishing a general water station record.

Methods and Forms for Keeping Up-to-Date Valuation and Other Records—The committee presented a list of the forms which it had submitted to the association in previous years and then offered the results of its study of these forms to determine those which are obsolete and of little use, those which should be held in abeyance, and those which should be retained, with or without revision. Thirty-four forms were given consideration.

Methods Used in Recapture Proceedings—In a progress report, the committee reviewed important legislation of the year having bearing on valuation and recapture, and then presented brief summary statements with regard to the status of the more important valuation and recapture cases, including the R. F. & P. case, the St. Louis & O'Fallon case, and those involving the Lehigh & New England, the Norfolk & Western, the Pere Marquette, and the Bessemer & Lake Erie.

Depreciation Charges of Steam Railways—In a brief report, the committee stated that under date of March 14, 1932, the effective date, requirements of I.C.C. Order No. 15100—Depreciation Charges of Steam Railway Companies—were officially postponed for one year; the primary account composite depreciation rates to be submitted by Sept. 1, 1933, and depreciation accounting inaugurated Jan. 1, 1934. It said that it had made substantial progress in preparing a complete report on recommended procedure and forms under the requirements of the

* Auditor Capital Expenditures, Illinois Central System.

March, 1932, tentative draft, which report could be brought into accord with the final text of the classifications very shortly after their promulgation.

Simplifying and Co-ordinating Work Under Requirements of I.C.C.—The committee called attention to a tentative draft of a new uniform system of accounts for steam railways, prepared by the I.C.C. shortly after the last convention, in which an attempt was made to co-ordinate its procedure with respect to property investment accounting, with valuation and depreciation matter. After commenting on this tentative draft, the committee said, in part, as follows:

The committee has reached the conclusion that it is practicable to design a single system of records and reports for all regulatory purposes of the I.C.C., as well as for carrier use—provided the problem is worked out by the use of intelligent engineering and accounting judgment.

There has been and still is considerable confusion in the dealing of the carriers with the commission on this subject. The existing conditions will obtain until the carriers co-ordinate their activities in presenting their views to the commission.

This committee has reported many times to this association that it is a bystander in its relationship to this subject, and that until such time as it is recognized as a carrier agency working for a common good in an attempt to furnish practical solutions for problems that are essentially within its field of activity, its efforts are probably wasted. The committee recommends, however, that the subject be continued on its docket in order that the necessity for united action may be kept before the membership of the association.

Preparing Data for Rate and Other Cases—In view of radical changes in accounting procedure proposed by the I.C.C. and discussions dealing with valuation which have taken place in Congress, the committee reported that any effort on its part to make recommendations at this time would be wasted. It offered to present recommendations when the present confusion and uncertainty have been cleared away.

Bibliography—The committee presented a bibliographical review of books and articles appearing from November, 1931, to October, 1932, having to do with subjects with which it is concerned, including the general railway situation, valuation and depreciation accounting.

Report on Wood Preservation

F. C. Shepherd, Chairman*

The report carried forward the records of tests being conducted by or for the committee and contained information on several new subjects.

Specifications For Treatment of Air-Seasoned Douglas Fir—The studies during the year on this assignment were directed largely toward the incising of Douglas fir bridge timbers and test treatments of Douglas fir. Relative to the first subject, the committee presented excerpts from a report of the results of extensive laboratory tests made by E. E. Chapman, engineer of tests of the Sante Fe, to determine the effect of incising and treatment on the strength of 7-in. by 16-in. Douglas fir stringers.

Based largely on the findings of Mr. Chapman's investigations, the committee recommended that Douglas fir ties, and all lumber more than 2 in. in thickness, be incised on four sides, the incisor teeth to be not more than $^{9}/_{32}$ in. thick, and the pattern for the incisions to be in accordance with a plan which the committee submitted. It recommended further, that incisions be ¾ in. deep for all sawed Douglas fir 6 in. thick or over, and that incisions ½ in. deep be used in the sides, and ¾ in. deep in the edges, of all sawed fir less than 6 in. thick and more than 2 in. thick. The incising of material less than 2 in. thick was not recommended.

The committee reported on the test treatments of Douglas fir which it had been carrying out, and then presented, as information, specifications for the treatment of air-seasoned Douglas fir, prepared largely as a result of its own test work and the experience of others.

Destruction by Termites and Means of Prevention—The committee reported increased observation of termite activity in practically all parts of the country, and again urged increased attention to safeguards, especially in new building construction. It outlined tests that are now under way to determine the value of soil poisons in preventing termite attacks.

The report also called attention to recent attacks by "wharf borers" on piles in the vicinity of New York, and included notes on "The Wharf Borer," compiled by Dr. T. E. Snyder, of the Bureau of Entomology, Washington, D. C.

Dr. Herman von Schrenk (consulting timber engineer), chairman of the subcommittee making this report, explained that the "wharf borer" is not a termite but belongs to a higher class of insect. Dr. von Schrenk also summarized the contents of a moving picture devoted to the subject of termites, that was produced in Europe and is now being shown at certain points in this country.

Protecting Treated Materials in the Field—After calling attention to material which has already been presented to the association, and pointing out that the service life to be obtained through the proper treatment of timber is dependant largely on adherence to definite rules in the handling, care and efficient use of such timber, the committee submitted, as tentative, a group of rules, designed to bring about the most desirable practice. These rules cover mainly crossties, switch ties, signal timber and trunking, and telegraph poles.

Service Test Records of Treated Ties—As in the past, the report included the usual table of tie renewals per mile maintained on various roads, brought up to include renewals for 1931, and also reports on a number of special test sections on various roads.

Piling Used for Marine Construction—The committee reported on the present condition of the long-time test pieces prepared or observed by itself, the Chemical Warfare Service, and other co-operators, and, in addition, presented several foreign reports on subjects of interest in connection with its work.

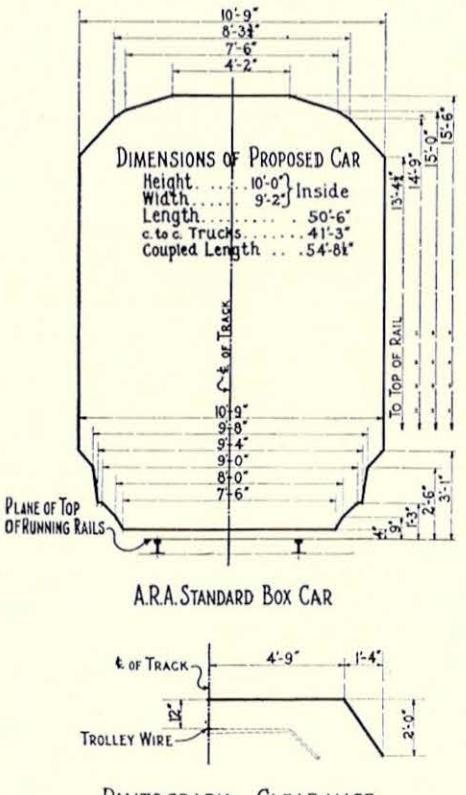
Revision of Manual—The committee presented a volume correction table for creosote, creosote-coal tar solution and coal tar, and another table giving the temperatures at which fractions should be cut to correct distillation temperatures for different altitudes. Both tables were offered for adoption and inclusion in the Manual and were so accepted.

* Consulting Engineer, Boston & Maine.

Report on Clearances

A. R. Wilson, Chairman*

As its report this year, the committee presented as information, without comment, an outline of the proposed A. R. A. box car and a clearance diagram for pantograph operation. The clear-



A.R.A. STANDARD BOX CAR

PANTOGRAPH CLEARANCE

Sketches of Proposed Standard Box Car and Pantograph Clearance

ance diagram for pantograph operation is for a car on tangent track and includes an allownce for sway of the car. On curved track, it is intended that the clearance shall be increased because of the superelevation of the outer rail.

* Engineer of Bridges, Pennsylvania.

Report on Maintenance of Way Work Equipment

C. R. Knowles, Chairman*

As a result of carrying forward its work during the year, the committee reported in considerable detail on six of the subjects assigned to it, and, in addition, reported progress in its consideration of 11 other subjects.

Standardization of Motor Car Parts—Continuing its studies and recommendations of recent years on the standardization of parts and accessories for motor cars, the committee this year gave special consideration to feed line connections, size of cord belts, gas tanks, brake shoes and ignition systems. As a result, it offered brief specifications relative to each of these parts, together with a detailed drawing of gasoline line connections, which it recommended for adoption as recommended practice.

All of these recommendations were adopted.

Snow Melting Devices—In a comprehensive report of 26 pages the committee gave detailed consideration to the various types of snow melting devices on the market, with special reference to them as an aid in facilitating train operation and in reducing maintenance costs. The report was introduced with a general discussion of the problems giving rise to the use of snow melters, and was closed with a list of manufacturers of snow melters; a list of the roads using them; a bibliography of published material on the subject; and the conclusions of the committee to the effect that, under proper conditions, snow melting devices are an aid in facilitating train operation and in reducing maintenance expense, and that the best type and design for the purpose are worthy of some study. All of the more important types of snow melting devices were described briefly in the report and many examples were presented of instances where the use of these devices during storms had a marked beneficial effect on maintaining traffic and in minimizing the expense of snow and ice removal.

Tractors in Maintenance Work—The report of the committee was confined to the use and adaptability of track-type tractors in maintenance of way work, and dealt thoroughly with the subject, including numerous specific examples of the use of tractors in this class of work, with performance records, cost data, and photographs taken on the job.

Following a general description of tractors, the committee listed 23 attachments or units of auxiliary equipment, which are available to meet the specific needs of maintenance work including: Air compressors, backfillers, booms, brooms, bulldozers, ditchers, hoists, graders, loaders, mowers, post hole diggers, pumps, rock crushers, saws, dragline scrapers, rotary scrapers, wheel scrapers, snow plows, stump pullers, trailers, wagons, welding generators, and winches.

The committee also stated that these machines had been used in bank widening; cleaning under bridges; cleaning out culverts; cleaning track ditches; ditching around culverts; ditching for surface drainage; excavating for tracks; excavating for buildings, bridges and grade separations; plowing fire guards; laying rail; leveling the right-of-way; leveling yards, cinder dumps and trash piles; running tamping machines; mowing weeds; loading, unloading and hauling miscellaneous material; removing snow around warehouses, crossings, tracks, platforms and driveways; moving and removing tracks; switching cars; spray painting and other jobs requiring compressed air; stripping gravel pits; pumping water; operating elevators for hoisting building material; pulling stumps, clearing right-of-way; cleaning out and digging new reservoirs with dragline; moving buildings; tearing down buildings; clearing derailments; welding rail ends, frogs and switch points; and stringing telephone and signal wires and cables, both overhead and underground.

In summary the report stated that: (1) The track type tractor works with a minimum interference to rail traffic, (2) Work can be done at points not served by tracks, (3) The tractor can be loaded on a flat car by its own power, (4) The smaller sizes can be transported on a heavy-duty push car or moved along the right-of-way under its own power, (5) The tractor is adaptable for use with small gangs, (6) It can be used independently or as a part of larger operations, such as leveling ridges left by ditcher spreaders, etc., (7) It is suitable for work during all seasons of the year, (8) It does not require a skilled operator but can be driven by labor of ordinary intelligence and experience, (9) It can operate over ground where teams or wheeled vehicles would bog.

As a result of its study of tractors, the committee came to the following conclusion:

Supplemented with suitable auxiliary equipment, track-type tractors are adapted to the economical and efficient performance of many classes of maintenance of way work and are sufficiently versatile to permit of all-year use.

This report was supplemented by a talking moving picture, showing the various applications in railroad service to which track type tractors are adapted.

Use and Maintenance of Tie Tamping Machines—As the result of the study of this subject, particularly from the standpoint of organization, the committee came to the conclusion that, generally speaking, there are few fundamental differences in the methods employed. It did, however, present what appeared to it to be the best balanced gang organizations for good, economical surfacing work with the most commonly used types of pneumatic and electric tamping units. It also presented a concise statement of what appeared to it to be the best practical standards to follow, both as regards the operation and maintenance of tie tamping equipment, this being done with the thought that each road could apply these standards with such modifications as its individual requirements dictate.

Tie Adzing, Scoring and Boring Machines—In developing its report, the committee gave consideration only to the adzing and boring of ties in the field and not at treating plants. Passing over the subject of wood boring machines hurriedly because of the fact that these machines have been in general use for a number of years, the committee presented a discussion of the features and adaptability of scoring and adzing machines. In closing its report, the committee offered the following conclusions:

While it is possible to obtain good riding track by laying rail on ties adzed by hand, without the use of any machinery, and to do the work in such a manner as to provide good bearing for the rail without bending of tie plates and consequent damage to rail, this is a costly method of doing the work. A much better job of adzing can be obtained by the use of the scoring machine in connection with hand adzing, and a better and much less costly job can be obtained by employing adzing machines.

Uniform machine adzing can be obtained by the use of a scoring machine ahead of an adzing machine to score a groove in each tie. Providing the adzing machine with a runner to take bearing in the bottom of the groove would control the amount of adzing and not leave it to the judgment of the operator.

Ditching-Spreaders—The report of the committee, which was confined solely to consideration of the wing and box-types of ditching-spreaders, was presented under the following heads: Introduction, history and development, types and age of machines reported, system equipment, operations performed, derailing, operators, crews, responsibility for operation and performance, ditching-spreaders versus other methods, miles per day, savings through use, cost per cubic yard, days worked per year, comments on wing-type machine, and comments on box-type machine.

Under operations performed, the committee reported: (a) Cleaning, ditching, and shaping of roadbed, shoulder and ditch, (b) bank sloping of cuts, (c) bank widening on fills, (d) dragging dirt out of cuts on to fills, (e) distribution, shaping and dressing of ballast, (f) spreading for second main or additional tracks and track elevation work, (g) removal of snow from main lines adjacent to yard tracks, (h) removal of snow and ice between and outside of rails with front plow, wings and ice cutting attachment, (i) plowing off stone ballast shoulder for cleaning, (j) leveling back old ballast shoulder below bottom of ties, previous to applying new gravel or rock ballast, (k) cutting down subgrade from 18 in. to 20 in. below bottom of ties and about 8 in. from end of ties to get rid of bad material in subgrade, and (l) spreading cinder piles at the various engine houses or cinder dumps.

The committee said further in part, as follows:

That the adaptability and economy of the ditching-spreader in ditching operations is fully realized is illustrated forcibly by the fact that over one-half of the lines report that they now use this unit to perform 80 per cent or more of this kind of work, which was formerly done by other methods. The varied nature of the work done by these machines is such that no definite figures as to cost per yard or mile of ditch cleaned or made can be given. However, reports indicate that the use of the machine results in savings as high as 80 per cent under the cost of hand and team work, and 60 per cent under the cost of ditching by the dipper type of ditchers.

It is obviously difficult to show definitely the cost of moving material without taking into consideration the nature of the material handled and conditions under which the work is done. Costs range from 17 cents to 25 cents per cubic yard with ditching-spreaders, while hand work ranges from 35 cents to $1, team work 25 cents to $1, and steam or gasoline ditcher work 17 cents to 52 cents.

Other subjects—The committee reported progress on the following subjects assigned to it:

Revision of the Manual; adaptability of air and electric driven tools in maintenance work (track grinders); methods of keeping

* Superintendent Water Service, Illinois Central.

data on work equipment and labor-saving devices; the selection and training of maintainers and operators of work equipment; use of ballast discers; rail laying machines and auxiliary equipment; use of weed destroying equipment; manual of instructions for care and operation of work equipment; the use and maintenance of paint spraying equipment; organization for the use and maintenance of ballast cleaning machines; and the use of oil spraying machines for oiling rails and fastenings, steel structures and roadbed.

Report on Ballast

A. P. Crosley, Chairman*

Five subjects relating to ballast were reported on in some detail by the committee.

Proper Depth and Kind of Sub-Ballast—From its study of sub-ballast, the committee concluded that many materials, including stone screenings, pit-run gravel, cinders, slag, sand, etc., are used for sub-ballast with satisfactory results, so it made no recommendation regarding the relative merits of the different materials other than to say that the materials of smaller aggregates are to be preferred because of their greater tendency to prevent the roadbed material from working up into the top ballast. Because of the many factors involved, the committee found it impracticable to determine definitely the proper depth of sub-ballast, but stated its belief that when the top ballast consists of large aggregates and the sub-ballast of small aggregates, a combination of top ballast and sub-ballast of a ratio to be governed by local conditions will give better results than if top ballast material is used for the entire depth of the ballast section. Based on these conclusions, the committee recommended several changes in material already in the Manual, principally that having to do with the definition of sub-ballast and the desirable depth of this material.

The committee's new definition for sub-ballast was adopted but after criticism by R. H. Ford (C. R. I. & P.) to the proposed recommendations for depth of ballast, on the ground that any statement of specific depths was, of necessity, unsound from a scientific standpoint, the committee withdrew the recommendations.

Specifications for Prepared Gravel Ballast—In a progress report on this subject, which called specifically for recommendations relative to the best method of testing gravel ballast for hardness, abrasion and resistance to weathering, the committee presented a summary of the information which it had secured as a result of a questionnaire, and through specific laboratory tests on samples of gravel ballast. It reported quite general approval of the association's specifications for prepared gravel ballast, and was encouraged in the belief that the specifications are in a form practical of application to the needs of all roads, although it recognizes the desirability, in some instances, of individual roads introducing modifications to suit local conditions.

The committee had been hopeful that a study of the replies to its questionnaire and of the results of its laboratory tests would permit definite recommendations to be drafted for specification limits covering hardness, resistance to abrasion and weathering, and other factors not included in the present specifications, but stated that its studies thus far do not permit such recommendations.

Testing Resistance to Weathering of Stone Ballast—The committee reported that it had continued to keep before it the standard specifications for stone ballast, with the thought of keeping them up-to-date, but proposed no changes at this time. It called attention to several new test methods, however, and presented for consideration an alternate specification for making tests of crushed stone as produced for ballast, this alternate specification test being known as the "Modified Abrasion Test."

Relative to the selection of samples for test, the committee said: It seems that when selecting samples from a quarry in operation, the samples should be taken from the prepared stone ballast instead of from a quarry ledge or face where the stone is rarely representative since it has not been subjected to the effects of the crushing and screening operations through which the prepared stone passes.

The committee also reported that it is giving further consideration to the question of removing from the present specifications, the section dealing with cementing value.

Costs of Maintaining Track on Various Kinds of Ballast—Continuing its report of last year in which it presented, in detailed tabular form, comparative maintenance cost figures for two sections of line, one ballasted with stone and the other with gravel, the committee presented this year comparative maintenance costs on these same sections during 1931. It reported also, that information was in hand relative to the maintenance costs on another pair of comparable sections.

Effect of Different Ballasts on Ties, Rail, Etc.—In its first year's study of this subject, it became apparent to the committee that a large number of factors must be taken into consideration before an attempt can be made to formulate a comparison between the effects of different kinds of ballast on the life of ties and rail. After pointing out that damage to ties by ballast may come under the heads of indentation, rounding, splitting, tamping bruises, broken ends, and breaks between rails, and giving its experience as regards the relative severity of these different kinds of damage in gravel and crushed stone ballasted track, the committee said, in part, as follows:

Without any means of evaluating the above classes of damage, or statistics to back up conclusions, it is felt from present information, that a somewhat greater age will be attained by the average tie in stone ballast than in gravel ballast under identical roadbed, rail, and traffic conditions.

Following this part of the report, the committee discussed briefly the possible effects of ballast on the life of rail, mentioning detail fractures, split heads, bolt hole breaks, sudden ruptures, mashed and battered ends, and reduction of section by chemical action (rust, electrolysis, etc.)

Other Subjects—Progress was reported on the effect of better and deeper ballast on the cost of lining and surfacing.

Report on Yards and Terminals

H. L. Ripley, Chairman*

In a detailed report, the committee presented its findings on six subjects; recommended a number of changes and additions to the Manual; and reported progress on several other subjects.

Produce Terminals—Continuing its study of previous years, the committee presented a condensed summary of the information on produce terminals which it secured in 1931 as a result of a questionnaire. It also submitted a list of 40 rules or important points to be considered in the design and construction of such terminals, with the recommendation that they be adopted for publication in the Manual. These rules have to do specifically with the type of terminal, buildings, track layout, driveways, platforms, icing, garbage and refuse disposal, and miscellaneous features.

Hump Yards—Continuing its report of last year, in which formulas were presented for determining the required drop from the crest of the hump to the clearance point of any track, the drop from the leaving end of the last retarder in any group to the clearance point of any track in any group, and the drop from the crest of the hump to the leaving end of the last retarder, the committee this year presented studies of graphic methods which may be used in designing gradients in connection with the application of retarders to hump yards. It said in part as follows:

After a classification yard has been laid out and the required vertical drops have been determined, the distribution of these drops in their respective zones may be worked out by graphic methods in order that the speed of cars may be properly controlled and each retarder do its share of the work. The graphic method may be also used in making an analysis of the grades and retarder capacities of an existing yard, as well as in the study of any design under consideration.

Two graphic methods were explained in the report and their application was demonstrated by specific examples.

Co-ordination of Air Ports and Rail Facilities—In a thorough report, the committee discussed the present extent of air lines and air facilities; co-ordination between rail and air services; location of airports in co-ordination with railway facilities; the design of airports in co-ordination with rail facilities; and the advantages possible through air-rail co-ordination. It pointed out that, at the present time, the best example of air-rail co-ordination is that existing through the Railway Express Agency, wherein the express agency provides all-air express between points served by a large number of air lines, and a combination of air and rail express to all points in the United States, using its own trucks for pick-up and delivery service. It stated that a service similar to this, permitting passengers to make full use of both air and rail travel, would be a distinct advance in the art of transportation. At the end of its report, the committee submitted a list of existing co-ordinated air and rail facilities for passenger service.

Scales—The committee recommended revision of a part of the rules for the location, maintenance, operation and testing of railway track scales, under Section VI—Test Weight Cars, in the Manual, and, with the view of revising the remainder of

* Division Engineer, Reading.

* Construction Engineer, New York, New Haven & Hartford.

Report on Maintenance of Way Work Equipment

C. R. Knowles, Chairman*

As a result of carrying forward its work during the year, the committee reported in considerable detail on six of the subjects assigned to it, and, in addition, reported progress in its consideration of 11 other subjects.

Standardization of Motor Car Parts—Continuing its studies and recommendations of recent years on the standardization of parts and accessories for motor cars, the committee this year gave special consideration to feed line connections, size of cord belts, gas tanks, brake shoes and ignition systems. As a result, it offered brief specifications relative to each of these parts, together with a detailed drawing of gasoline line connections, which it recommended for adoption as recommended practice.

All of these recommendations were adopted.

Snow Melting Devices—In a comprehensive report of 26 pages the committee gave detailed consideration to the various types of snow melting devices on the market, with special reference to them as an aid in facilitating train operation and in reducing maintenance costs. The report was introduced with a general discussion of the problems giving rise to the use of snow melters, and was closed with a list of manufacturers of snow melters; a list of the roads using them; a bibliography of published material on the subject; and the conclusions of the committee to the effect that, under proper conditions, snow melting devices are an aid in facilitating train operation and in reducing maintenance expense, and that the best type and design for the purpose are worthy of some study. All of the more important types of snow melting devices were described briefly in the report and many examples were presented of instances where the use of these devices during storms had a marked beneficial effect on maintaining traffic and in minimizing the expense of snow and ice removal.

Tractors in Maintenance Work—The report of the committee was confined to the use and adaptability of track-type tractors in maintenance of way work, and dealt thoroughly with the subject, including numerous specific examples of the use of tractors in this class of work, with performance records, cost data, and photographs taken on the job.

Following a general description of tractors, the committee listed 23 attachments or units of auxiliary equipment, which are available to meet the specific needs of maintenance work including: Air compressors, backfillers, booms, brooms, bulldozers, ditchers, hoists, graders, loaders, mowers, post hole diggers, pumps, rock crushers, saws, dragline scrapers, rotary scrapers, wheel scrapers, snow plows, stump pullers, trailers, wagons, welding generators, and winches.

The committee also stated that these machines had been used in bank widening; cleaning under bridges; cleaning out culverts; cleaning track ditches; ditching around culverts; ditching for surface drainage; excavating for tracks; excavating for buildings, bridges and grade separations; plowing fire guards; laying rail; leveling the right-of-way; leveling yards, cinder dumps and trash piles; running tamping machines; mowing weeds; loading, unloading and hauling miscellaneous material; removing snow around warehouses, crossings, tracks, platforms and driveways; moving and removing tracks; switching cars; spray painting and other jobs requiring compressed air; stripping gravel pits; pumping water; operating elevators for hoisting building material; pulling stumps, clearing right-of-way; cleaning out and digging new reservoirs with dragline; moving buildings; tearing down buildings; clearing derailments; welding rail ends, frogs and switch points; and stringing telephone and signal wires and cables, both overhead and underground.

In summary the report stated that: (1) The track type tractor works with a minimum interference to rail traffic, (2) Work can be done at points not served by tracks, (3) The tractor can be loaded on a flat car by its own power, (4) The smaller sizes can be transported on a heavy-duty push car or moved along the right-of-way under its own power, (5) The tractor is adaptable for use with small gangs, (6) It can be used independently or as a part of larger operations, such as leveling ridges left by ditcher spreaders, etc., (7) It is suitable for work during all seasons of the year, (8) It does not require a skilled operator but can be driven by labor of ordinary intelligence and experience, (9) It can operate over ground where teams or wheeled vehicles would bog.

As a result of its study of tractors, the committee came to the following conclusion:

Supplemented with suitable auxiliary equipment, track-type tractors are adapted to the economical and efficient performance of many classes of maintenance of way work and are sufficiently versatile to permit of all-year use.

This report was supplemented by a talking moving picture, showing the various applications in railroad service to which track type tractors are adapted.

Use and Maintenance of Tie Tamping Machines—As the result of the study of this subject, particularly from the standpoint of organization, the committee came to the conclusion that, generally speaking, there are few fundamental differences in the methods employed. It did, however, present what appeared to it to be the best balanced gang organizations for good, economical surfacing work with the most commonly used types of pneumatic and electric tamping units. It also presented a concise statement of what appeared to it to be the best practical standards to follow, both as regards the operation and maintenance of tie tamping equipment, this being done with the thought that each road could apply these standards with such modifications as its individual requirements dictate.

Tie Adzing, Scoring and Boring Machines—In developing its report, the committee gave consideration only to the adzing and boring of ties in the field and not at treating plants. Passing over the subject of wood boring machines hurriedly because of the fact that these machines have been in general use for a number of years, the committee presented a discussion of the features and adaptability of scoring and adzing machines. In closing its report, the committee offered the following conclusions:

While it is possible to obtain good riding track by laying rail on ties adzed by hand, without the use of any machinery, and to do the work in such a manner as to provide good bearing for the rail without bending of tie plates and consequent damage to rail, this is a costly method of doing the work. A much better job of adzing can be obtained by the use of the scoring machine in connection with hand adzing, and a better and much less costly job can be obtained by employing adzing machines.

Uniform machine adzing can be obtained by the use of a scoring machine ahead of an adzing machine to score a groove in each tie. Providing the adzing machine with a runner to take bearing in the bottom of the groove would control the amount of adzing and not leave it to the judgment of the operator.

Ditching-Spreaders—The report of the committee, which was confined solely to consideration of the wing and box-types of ditching-spreaders, was presented under the following heads: Introduction, history and development, types and age of machines reported, system equipment, operations performed, derailing, operators, crews, responsibility for operation and performance, ditching-spreaders versus other methods, miles per day, savings through use, cost per cubic yard, days worked per year, comments on wing-type machine, and comments on box-type machine.

Under operations performed, the committee reported: (a) Cleaning, ditching, and shaping of roadbed, shoulder and ditch, (b) bank sloping of cuts, (c) bank widening on fills, (d) dragging dirt out of cuts on to fills, (e) distribution, shaping and dressing of ballast, (f) spreading for second main or additional tracks and track elevation work, (g) removal of snow from main lines adjacent to yard tracks, (h) removal of snow and ice between and outside of rails with front plow, wings and ice cutting attachment, (i) plowing off stone ballast shoulder for cleaning, (j) leveling back old ballast shoulder below bottom of ties, previous to applying new gravel or rock ballast, (k) cutting down subgrade from 18 in. to 20 in. below bottom of ties and about 8 in. from end of ties to get rid of bad material in subgrade, and (l) spreading cinder piles at the various engine houses or cinder dumps.

The committee said further in part, as follows:

That the adaptability and economy of the ditching-spreader in ditching operations is fully realized is illustrated forcibly by the fact that over one-half of the lines report that they now use this unit to perform 80 per cent or more of this kind of work, which was formerly done by other methods. The varied nature of the work done by these machines is such that no definite figures as to cost per yard or mile of ditch cleaned or made can be given. However, reports indicate that the use of the machine results in savings as high as 80 per cent under the cost of hand and team work, and 60 per cent under the cost of ditching by the dipper type of ditchers.

It is obviously difficult to show definitely the cost of moving material without taking into consideration the nature of the material handled and conditions under which the work is done. Costs range from 17 cents to 25 cents per cubic yard with ditching-spreaders, while hand work ranges from 35 cents to $1, team work 25 cents to $1, and steam or gasoline ditcher work 17 cents to 52 cents.

Other subjects—The committee reported progress on the following subjects assigned to it:

Revision of the Manual; adaptability of air and electric driven tools in maintenance work (track grinders); methods of keeping

* Superintendent Water Service, Illinois Central.

data on work equipment and labor-saving devices; the selection and training of maintainers and operators of work equipment; use of ballast discers; rail laying machines and auxiliary equipment; use of weed destroying equipment; manual of instructions for care and operation of work equipment; the use and maintenance of paint spraying equipment; organization for the use and maintenance of ballast cleaning machines; and the use of oil spraying machines for oiling rails and fastenings, steel structures and roadbed.

Report on Ballast

A. P. Crosley, Chairman*

Five subjects relating to ballast were reported on in some detail by the committee.

Proper Depth and Kind of Sub-Ballast—From its study of sub-ballast, the committee concluded that many materials, including stone screenings, pit-run gravel, cinders, slag, sand, etc., are used for sub-ballast with satisfactory results, so it made no recommendation regarding the relative merits of the different materials other than to say that the materials of smaller aggregates are to be preferred because of their greater tendency to prevent the roadbed material from working up into the top ballast. Because of the many factors involved, the committee found it impracticable to determine definitely the proper depth of sub-ballast, but stated its belief that when the top ballast consists of large aggregates and the sub-ballast of small aggregates, a combination of top ballast and sub-ballast of a ratio to be governed by local conditions will give better results than if top ballast material is used for the entire depth of the ballast section. Based on these conclusions, the committee recommended several changes in material already in the Manual, principally that having to do with the definition of sub-ballast and the desirable depth of this material.

The committee's new definition for sub-ballast was adopted but after criticism by R. H. Ford (C. R. I. & P.) to the proposed recommendations for depth of ballast, on the ground that any statement of specific depths was, of necessity, unsound from a scientific standpoint, the committee withdrew the recommendations.

Specifications for Prepared Gravel Ballast—In a progress report on this subject, which called specifically for recommendations relative to the best method of testing gravel ballast for hardness, abrasion and resistance to weathering, the committee presented a summary of the information which it had secured as a result of a questionnaire, and through specific laboratory tests on samples of gravel ballast. It reported quite general approval of the association's specifications for prepared gravel ballast, and was encouraged in the belief that the specifications are in a form practical of application to the needs of all roads, although it recognizes the desirability, in some instances, of individual roads introducing modifications to suit local conditions.

The committee had been hopeful that a study of the replies to its questionnaire and of the results of its laboratory tests would permit definite recommendations to be drafted for specification limits covering hardness, resistance to abrasion and weathering, and other factors not included in the present specifications, but stated that its studies thus far do not permit such recommendations.

Testing Resistance to Weathering of Stone Ballast—The committee reported that it had continued to keep before it the standard specifications for stone ballast, with the thought of keeping them up-to-date, but proposed no changes at this time. It called attention to several new test methods, however, and presented for consideration an alternate specification for making tests of crushed stone as produced for ballast, this alternate specification test being known as the "Modified Abrasion Test."

Relative to the selection of samples for test, the committee said: It seems that when selecting samples from a quarry in operation, the samples should be taken from the prepared stone ballast instead of from a quarry ledge or face where the stone is rarely representative since it has not been subjected to the effects of the crushing and screening operations through which the prepared stone passes.

The committee also reported that it is giving further consideration to the question of removing from the present specifications, the section dealing with cementing value.

Costs of Maintaining Track on Various Kinds of Ballast—Continuing its report of last year in which it presented, in detailed tabular form, comparative maintenance cost figures for two sections of line, one ballasted with stone and the other with gravel, the committee presented this year comparative maintenance costs on these same sections during 1931. It reported also, that information was in hand relative to the maintenance costs on another pair of comparable sections.

Effect of Different Ballasts on Ties, Rail, Etc.—In its first year's study of this subject, it became apparent to the committee that a large number of factors must be taken into consideration before an attempt can be made to formulate a comparison between the effects of different kinds of ballast on the life of ties and rail. After pointing out that damage to ties by ballast may come under the heads of indentation, rounding, splitting, tamping bruises, broken ends, and breaks between rails, and giving its experience as regards the relative severity of these different kinds of damage in gravel and crushed stone ballasted track, the committee said, in part, as follows:

Without any means of evaluating the above classes of damage, or statistics to back up conclusions, it is felt from present information, that a somewhat greater age will be attained by the average tie in stone ballast than in gravel ballast under identical roadbed, rail, and traffic conditions.

Following this part of the report, the committee discussed briefly the possible effects of ballast on the life of rail, mentioning detail fractures, split heads, bolt hole breaks, sudden ruptures, mashed and battered ends, and reduction of section by chemical action (rust, electrolysis, etc.)

Other Subjects—Progress was reported on the effect of better and deeper ballast on the cost of lining and surfacing.

Report on Yards and Terminals

H. L. Ripley, Chairman*

In a detailed report, the committee presented its findings on six subjects; recommended a number of changes and additions to the Manual; and reported progress on several other subjects.

Produce Terminals—Continuing its study of previous years, the committee presented a condensed summary of the information on produce terminals which it secured in 1931 as a result of a questionnaire. It also submitted a list of 40 rules or important points to be considered in the design and construction of such terminals, with the recommendation that they be adopted for publication in the Manual. These rules have to do specifically with the type of terminal, buildings, track layout, driveways, platforms, icing, garbage and refuse disposal, and miscellaneous features.

Hump Yards—Continuing its report of last year, in which formulas were presented for determining the required drop from the crest of the hump to the clearance point of any track, the drop from the leaving end of the last retarder in any group to the clearance point of any track in any group, and the drop from the crest of the hump to the leaving end of the last retarder, the committee this year presented studies of graphic methods which may be used in designing gradients in connection with the application of retarders to hump yards. It said in part as follows:

After a classification yard has been laid out and the required vertical drops have been determined, the distribution of these drops in their respective zones may be worked out by graphic methods in order that the speed of cars may be properly controlled and each retarder do its share of the work. The graphic method may be also used in making an analysis of the grades and retarder capacities of an existing yard, as well as in the study of any design under consideration.

Two graphic methods were explained in the report and their application was demonstrated by specific examples.

Co-ordination of Air Ports and Rail Facilities—In a thorough report, the committee discussed the present extent of air lines and air facilities; co-ordination between rail and air services; location of airports in co-ordination with railway facilities; the design of airports in co-ordination with rail facilities; and the advantages possible through air-rail co-ordination. It pointed out that, at the present time, the best example of air-rail co-ordination is that existing through the Railway Express Agency, wherein the express agency provides all-air express between points served by a large number of air lines, and a combination of air and rail express to all points in the United States, using its own trucks for pick-up and delivery service. It stated that a service similar to this, permitting passengers to make full use of both air and rail travel, would be a distinct advance in the art of transportation. At the end of its report, the committee submitted a list of existing co-ordinated air and rail facilities for passenger service.

Scales—The committee recommended revision of a part of the rules for the location, maintenance, operation and testing of railway track scales, under Section VI—Test Weight Cars, in the Manual, and, with the view of revising the remainder of

* Division Engineer, Reading.

* Construction Engineer, New York, New Haven & Hartford.

this section at some future time, submitted, as information, a series of rules for the maintenance and transportation of track scale test weight cars, and a definition (outline) of a standard test for a railway track scale.

Bibliography—The committee presented a bibliography of published articles, papers and books dealing with passenger stations and terminals; freight stations, terminals and yards; rail and water terminals; and airports.

Revision of Manual—Revisions proposed in the Manual had to do mainly with the material on test weight cars, the committee recommending the adoption of a set of specifications for railway track scale test weight cars, to be substituted for two of the paragraphs on these cars now appearing in the Manual. As an addition to the Manual, the committee offered formulas to be used in designing retarder hump yard gradients extending from the crest of the hump to the lower end of the classification yard. All of these revisions and additions were adopted.

Other Subjects—Progress was reported on the following subjects: Effect of motor coach and truck service on the design of way and terminal station facilities; provisions for parking and garage facilities for private automobiles of railway passengers at passenger terminals and way stations; grain elevator storage yards and plant tracks; and co-ordination of facilities at rail and water terminals.

Report on Track

C. R. Harding, Chairman*

The committee made detailed report on ten subjects, offering a number of additions to the Manual, and reported progress on five other subjects.

Track Tools—Continuing its study of track tools, the committee redrafted Plan No. 11—Claw Bar, adopted in 1930, which was made to include an alternate design of bar. This redrafted plan, dated September, 1932, was submitted with the recommendation that it replace the present drawing in the Manual. This plan was approved to replace the present drawing in the Manual.

Switches, Frogs, Crossings, Slip Switches, etc.—In conference with the Standardization committee of the Manganese Track Society, the committee prepared and presented for adoption Plan No. 600-A, showing the application of wing wheel risers to manganese steel frogs, railbound, solid and self-guarded. As a matter of information, the committee recommended that the bolt holes in switch points made of rolled manganese steel rails be drilled and not punched, and that the burrs be removed by grinding. Plan 600-A was adopted for inclusion in the Manual.

Track Construction in Paved Streets—Last year the committee submitted as information Plan 987, for straight double tongue switches for engine wheel base not over 14 ft. 6 in., for use in paved streets, dated November, 1931, and Plan 988, for straight double tongue switches for engine wheel base over 14 ft. 6 in. but not exceeding 19 ft., for use in paved streets, dated November, 1931. Having received no criticism of these plans during the year, the committee offered them for adoption as recommended practice. Both plans were adopted for publication in the Manual.

Standard Wheel Flanges, Treads and Gages—Plan No. 790, revised, dated November, 1932, A. R. E. A.—Data for gages and flangeways at frogs and crossings, showing limits where gage is not widened for curvature, was submitted with the recommendation that it be adopted and printed in the Manual. This plan is a revision of the same plan (No. 790) submitted as information last year. This plan was adopted for inclusion in the Manual.

Revision of Manual—The committee recommended the revision of the Index and Index Supplement to the A. R. E. A. track plans and specifications, Pages 1, 2, 3 and 4, dated 1932, by the substitution of a revised Index and Index Supplement dated 1933, Pages 1, 2, 3, 4, 5 and 6, listing existing plans and specifications and including the new plans presented in this year's report. It pointed out that Pages 4, 5 and 6 of the 1933 Index Supplement describe revisions to the plans, which are identified on Pages 1, 2 and 3 of the Index by the letter "x," following the serial number. The committee also called attention to the new plans which are being recommended for adoption this year by the different subcommittees. All of the revisions recommended by the committee were approved.

String Lining of Curves—Under this assignment, the committee described in detail the string lining of curves by the chord method, with an example illustrating the method and a group of tables suitable for the use of trackmen, giving the mid-ordinates for spirals of various lengths used in connection with circular curves of different degrees.

Effect of Roller Bearings on Elevation of Curves—Based on information furnished by the large manufacturers of roller bearings relative to the possible limits in the use of roller bearing equipment on curves at any desired speed of operation, the committee came to the conclusion that there is no different problem in the selection of the proper elevation for curves over which it is desired to operate railway equipment fitted with roller bearings, than is presented by the use of equipment with ordinary bearings.

Reflex Units for Switch Lamps and Targets—Based on replies to a questionnaire, the committee presented a summary of the present practice in the use of reflex units for switch lamps and targets, and for other purposes. Summarizing its findings, the committee said:

No definite conclusions can be reached now as to the efficiency of any type of reflex unit as a substitute for oil or electric switch lamps. The general opinion appears to question the value of reflecting devices in winter months and during heavy fog. It is a fact, however, that the three railroads which have a large number of these units in service report satisfactory aspects during the entire year, and these roads are so located that they have adverse atmospheric conditions at times.

Welding of Rail Ends—Selective vs. Out-of-Face—In a detailed report presenting the practices on a large number of roads with regard to the welding of rail ends, by both the oxy-acetylene and electric arc processes, and both selectively and out-of-face, the committee offered the following recommendation:

Unless companies already have some other satisfactory rule, and pending further investigation, the rule suggested is: That rail ends be built up by the selective method before enough have worn down to the allowable limit of wear to justify out-of-face work; but where rail has run until 50 per cent of the joints have reached the limit of wear, the work should be done by the out-of-face method.

Drainage From Brine Drippings—The committee pointed out that according to information furnished by the Mechanical division, A. R. A., only about two per cent of the 160,000 open-bunker type refrigerator cars in service, not equipped with devices for retaining water from melted ice, actually are in such service that they drip brine. Replies to a questionnaire indicated that only ten roads in the United States and Canada were seriously damaged by brine drippings. In view of these facts and the cost involved in equipping refrigerator cars to prevent the dripping of brine, the committee said that the Mechanical division representatives claim that the damage done does not justify the cost of the corrective measures necessary.

Other Subjects—Progress was reported on the following subjects: Specifications for soft steel track spikes; corrosion of rail and fastenings in tunnels; effect of existing materials in track on the design of tie plates and plate punchings; desirable tightness of track joints and effect upon the life of rails and joints of overtight joints; and reclamation of serviceable materials from scrap and of retired maintenance of way and structures machines, tools and appliances.

* Assistant to President, Southern Pacific.

Report on the Waterproofing of Railway Structures

J. A. Lahmer, Chairman*

The outstanding work of the committee for the year was the completion of specifications for the membrane waterproofing of concrete structures, except roofs of buildings, work on which has been under way for several years. The proposed specifications, which accompanied the committee's report, were submitted as information, with the request that members of the association review them and give the committee their comments and criticisms. The new specifications are built around the specifications for the waterproofing of solid floor railway bridges, adopted by the association in 1927, these specifications having been extended to apply to all concrete railway structures, except roofs of buildings, and revised to conform to present day practice. The new specifications are prepared under the five heads—Scope, design, types, materials and application, and include 76 articles.

The committee reported progress in its study of when to waterproof or dampproof, and methods to be used.

The report was accepted as information, the subject to be given further consideration by the committee during the following year. M. Hirschthal (D. L. & W.) urged that the ductility for coal-tar pitch for saturant and mopping be specified for 40 deg. F. as well as for 77 deg. F. as in the case of asphalt for saturant and mopping. Mr. Lahmer explained that the commit-

* Senior Assistant Engineer, Missouri Pacific.

tee had decided against this after careful consideration. B. R. Leffler (N. Y. C.) suggested that service records regarding the life and performance of asphalt plank could well have been included in the report. Mr. Lahmer replied that, owing to the short time that asphalt plank has been in use, reliable service records are not yet available.

Report on Ties

W. J. Burton, Chairman*

In a report submitted as information, the committee gave detailed consideration to 9 of the 11 subjects assigned to it. Abstracts of individual sections of the report follow:

Adherence to Standards—The committee reported that with the continued decline in tie purchases by the railways, there has continued a lack of competitive conditions in the industry which tempt consumers into deviations from standard specifications. Commenting on the surplus ties available in the industry and on the railways, it said, in part, as follows:

Millions of ties were given preservative treatment during 1932, adding to the stocks of similar ties already in storage awaiting use. If the creosoting of these ties was not put off until decay had started in them, their treatment should keep them in solid condition until they are needed, provided standard anti-splitting irons have been effectively applied.

Whenever the demand for ties develops, there will be presented for purchase quantities of them which have been held in the woods or on rights-of-way in styles of stacks not suitable for satisfactory seasoning. All such ties should be inspected individually with extreme care, and none accepted in stacks.

Substitute Ties—As in past years, the report this year consisted of a summarized statement of tests of substitute ties being conducted on a number of roads. No new tests were reported this year, and several of the tests usually mentioned were not included. Supplementing reference to tests in progress, the committee presented a list of tests of substitute ties conducted in the United States, beginning with one installed in 1878.

Renewal Averages Per Mile—For the fifth year, the committee presented tables giving crossties laid in replacement on different roads of the United States and Canada, those presented this year giving the figures for 1931. In addition, for the first time, the committee presented five-year averages of the replacement figures.

Comparison of Renewal Costs—Referring to the report on tie renewal averages per mile of track maintained, the committee listed all of the more important factors which have bearing on renewal costs. It also pointed out the factors bearing on the average cost of the ties used in renewals. Commenting on the variable conditions which affect tie renewals and tie cuts, the committee said in part:

Comparisons of the five-year averages will be found more accurate and valuable than those one-year periods. The averages reported are as reliable for the purpose of comparing results on different railroads as most other data commonly used in making comparisons of operating efficiency. There is no exact formula for comparing tie renewal costs, and none is possible, but knowledge of conditions will enable proper comparisons to be made, and these can be of great benefit in determining those tie policies which will be most beneficial in a given case.

Distributing Ties—After pointing out some of the factors to which consideration must be given in determining the most economical method of distributing ties from treating plants to the points where they are to be used, the committee stated that, in view of the widely varying conditions affecting this question at different locations, it was unable to recommend any one practice as being superior. In conclusion, it stated that in each case a careful study should be made by all departments concerned to determine just what was the best method, in view of conditions.

Economical Use for Old Ties—The committee opened its report with an expression of the opinion that the greatest economy can be realized by leaving a tie in its original location, if possible, until it is so decayed or worn mechanically that no further use can be had from it, but, recognizing that there are conditions or situations which justify the taking out and reuse of ties, it clearly pointed out these exceptions. It stated, however, that because of the cost of reinstalling ties, it is not considered economical to reuse ties unless they have an estimated life of five years in their new location. It said further:

When ties are reused, they should be put in track with the same surface up as in the original location, and all spike holes should be completely filled with treated tie plugs. When a satisfactory new bearing cannot be provided by carefully adzing the original top of the tie, it may be turned over. Creosote, (preferably hot) should be applied to all newly exposed surfaces.

Assuming that certain old ties cannot be reinserted under the specifications set up, the committee suggested a considerable number of possible uses for these ties, including fence posts, cribbing, paving for stock yards, scrap bins, mud sills, and for sale to adjacent land owners, or exchange with land owners for such work as grading, plowing of fire lines, mowing weeds, etc. In conclusion, the committee stated that the use of second-hand material can be, and frequently is, overdone, for the tendency seems to be to use it even where it is false economy to do so.

Eight-, 8½- or 9-Ft. Ties—The committee again stated its opinion that further data can be secured which will permit establishing reasonably correct limitations within which the different lengths and sizes of ties may be used economically. It advised of its plan later to establish suitable test sections where study and comparison can be made.

Other Subjects—The committee reported progress on the subject of how tie renewals may be predicted under a program involving a change from the use of untreated to treated ties, and, as its report on tie renewal practice, including methods of inspection and renewal, it presented the questionnaire which it has submitted to a number of roads.

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Report on Standardization

J. C. Irwin, Chairman*

Following introductory remarks in which the committee discussed the extent to which the recommended practices of the association are being used, and pointed out again the importance of uniformity of general practice in the handling of matters which involve relations between the railways themselves or between the railways and other interests, the committee reviewed the organization and purpose of the American Standards Association, and then reported on its meeting with representatives of this association on May 20, 1932.

Continuing its report, the committee discussed A. R. A. representation in the American Standards Association, the use and citation of A. S. A. standards, subjects recommended for National standardization, and the status of A. R. A. recommended standards for railroad-highway grade crossing protection. The subject-matter presented in connection with the last mentioned subject included a statement by Frank Ringer, chairman of the Joint Committee on Grade Crossing Protection, A. R. A., relative to the progress being made in securing adoption of uniform methods of protection.

The report of the committee again referred to the value of simplified practice and the progress made in this regard, and was concluded with a statement by B. Stuart McKenzie, secretary of the Canadian Engineering Standards Association, on the activities of that association during 1932. An appendix to the committee's report contained a list of the standards approved by the American Standards Association between September 1, 1931, and September 1, 1932.

Report on Stresses in Track

Arthur N. Talbot, Chairman†

In a short progress report, the special committee handling this subject stated that excellent progress had been made in the study of the experimental data accumulated in the field and laboratory tests referred to in its report of last year. The committee stated further, that the preliminary draft of the sixth progress report will soon be ready to send to the committee members for their consideration, and that it is hoped that the final form of the report will be ready for printing in a summer bulletin of the association.

Some of the accumulated material under study by the committee includes that with respect to joint bar tests on the Pennsylvania, and the Chesapeake & Ohio; tests of Geo track on the Missouri Pacific; and laboratory experimental work on several forms of rail joints, intended to supplement the field test data and to aid in their interpretation.

Dr. Talbot amplified the report by a discussion of some of the salient points of the forthcoming progress report, illustrating his talk with slides. He showed that the moment in joints under load ranges from 43 to 93 per cent of those developed in the full rail section under the same load applied statically. The committee investigations have shown that the adzing and preboring of ties reduces the stresses in both rail and joints

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and that beyond a certain limit, the wrenching of bolts gives little help in maintaining bolt tension, while it may have some undesirable effects. He suggested that greater attention be paid to the bearing of the rail on the tie plates.

Report on Rail

Earl Stimson, Chairman*

As in the past, the Committee on Rail presented detailed reports on a number of subjects dealing with rail design, composition, manufacture, and failures, as well as on certain rail fastenings, and reported progress on several other subjects of like nature.

Rail Heavier Than 100 lb. per Yard—Recognizing that certain of the R. E. sections of rail of 100 lb. per yard and more have failed to produce the best that could be obtained from the amount of metal used, the committee gave consideration to these sections this year, with special consideration to the 120-lb and 130-lb. sections. As a result, after special study of the Dudley 130-lb. section and the Pennsylvania 131-lb. section, it recommended the adoption of the Pennsylvania 131-lb. section to replace the present 130-lb. R. E. section. The specific recommendations of the committee as a result of its studies are given in the following:

(1) The committee agrees unanimously upon the Pennsylvania 131-lb. section shown on Fig. 1 and recommends its adoption and publication in the Manual as the standard 131-lb. R. E. rail section, in place of the present 130-lb. R. E. section, which section it is recommended be withdrawn from the Manual.

(2) As the 120, 140 and 150-lb. R. E. rail sections have never been used, and as the tendency is to increase the weight of rail used by increments of 20 lb. instead of 10 lb., it is recommended that these sections as shown in the 1929 Manual be withdrawn.

(3) In connection with the above recommendations it is recommended that the table headed "Application of recommended rail drilling to standard rail sections," Page 162 of the 1929 Manual, be revised to eliminate the drilling for the 120, 130 and 140-lb. R. E. sections.

(4) It is further recommended, that the height of bolt hole above base of rail, of 3¼ in. for the 131-lb. R. E. rail section, be added to the table referred to in recommendation 3.

As exhibit 1 of its report, the committee presented a letter received from Robert Faries, assistant chief engineer maintenance, Pennsylvania, outlining in detail the reasons which had brought about the design and adoption of the 131-lb. rail section on the Pennsylvania. The association adopted the 131-lb. section for inclusion in the Manual and approved the remaining recommendations.

Spring Washers—Collaborating with the Committee on Track, the committee submitted, for publication in the Manual, specifications for spring washers, which it recommended for use by those who purchase such devices. It was pointed out that presentation of the specifications does not imply recommendation by the committee either for or against the use of such washers. The specifications for spring washers were approved for publication in the Manual.

Rail Mill Practice and Manufacture—Progress was reported in the joint investigation under way at the University of Illinois by the Rail Committee and the Rail Manufacturers' Technical committee to determine the cause and remedy for transverse fissure and other rail failures. The committee reported that 5,000 tons of 130-lb. rail and 3,750 tons of 110-lb. rail have been rolled for it at five representative mills, and that service tests are under way.

Rail Failure Statistics for 1931—Rail failure statistics were presented by W. C. Barnes, engineer of tests for the committee, for the year ending December 31, 1931, these having been compiled in accordance with the standard method of basing the failure rate on mile years of service in track. This is the first report in which the report year coincides with the calendar year, the report year having ended on October 31 in previous years. As in the past, an analysis was given of the rollings by mills, and the report included a number of tables, diagrams and charts showing various trends in failure rates.

Transverse Fissure Statistics—The report on this subject, prepared by W. C. Barnes, was again a review of the transverse fissure situation, brought up to date. The record of transverse fissures reported, as given in the report, is as follows:

The accumulated grand total of fissure failures, service and detected, reported to December 31, 1931, from all rollings, was 58,227, or an addition during the year 1931 of 7,481. This is an increase of 770 over the total of 6,711 reported for the 11 months of 1930, but is only 159 more than said total prorated for the 12 months of 1930, namely 7,322. This increase is more than accounted for by the detection during 1931 of 2,686 fissured rails, which is 1,232 more than the 1,454 detected during the 11 months of 1930.

The total service failures for the 12 months of 1931 were 4,795, compared with a like total for the 11 months of 1930 of 5,257, a decrease in actual breakage in track of 462. The increase shown in the number of detected fissures is not an indication of the greater prevalence of fissures, but of the increased efficiency and use of methods of locating them in track before actual breakage.

A. R. A. Rail Fissure Detector Car—The committee reported continued satisfactory operation of the A. R. A. detector car, both from the standpoint of efficient performance and that of income to defray operating expenses and amortization charges. Relative to the performance of the car, it stated in part as follows:

On November 15, 1932, the car completed its fourth year in leasing service, having tested a total of 16,597 track miles of rail on roads in the United States and Canada, and having located a total of 1,551 transverse and compound fissure rails and a total of 7,187 defective rails of all types. The mileage

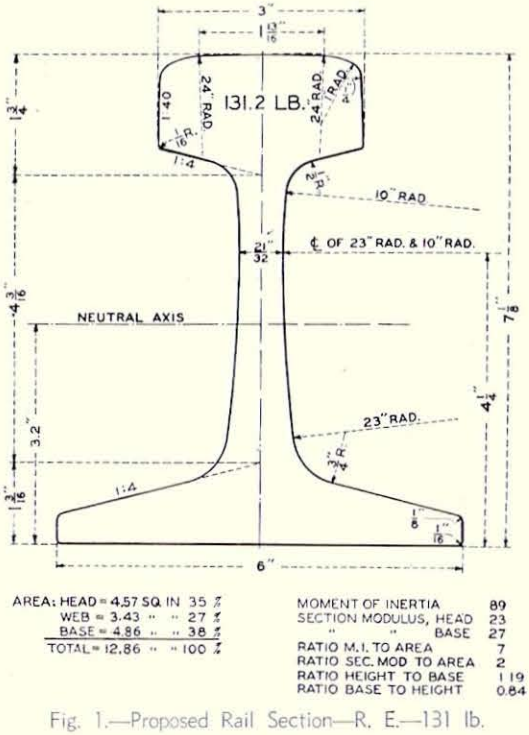

Fig. 1.—Proposed Rail Section—R. E.—131 lb.

tested the fourth year ending November 15, 1932, (5,579.8), exceeded the average of the first three years (3,672.5) by 51.9 per cent, and, at the same time, the miles tested per fissured rail decreased from 11.1 to 9.9, and the miles tested per defective rail (all types) from 3.2 to 1.5.

Rail Battering—The study of this subject was continued during the year with observations of tests. The committee stated that results thus far indicate that the heat treating of rail ends, when properly done, will materially retard rail end batter, and further, that definite progress is being made toward development of the most effective method of doing this work.

Revision of Manual—A number of changes in and additions to the Manual were recommended, these having to do largely with the carbon, manganese and silicon content of rail steel and the branding, stamping and classification markings of rails. These revisions and additions were approved.

Other Subjects—The committee reported progress on the following subjects: The application of upset joint bars on all rail badly worn on fishing surfaces; the economic value of different sizes of rail; compilation of information on tests of alloy and heat-treated carbon steel rails; and specifications for intermediate manganese steel rail.

As a part of the report, Prof. H. F. Moore (U. of I.) in charge of the joint investigation of the causes of rail failures, described the preliminary studies that have already been made and the plans which it is proposed to follow supplementing his talk with lantern slides.

* Chief Engineer Maintenance, Baltimore & Ohio.

Report on Roadway

C. W. Baldridge, Chairman*

The committee considered 12 subjects during the year and reported at some length on 9, offering several recommendations for additions to the Manual.

Roadbed Drainage—Continuing its report of last year on the same subject, the committee recommended for publication in the Manual information covering French and rock drains and with regard to the prevention of soft spots and water pockets. Under this latter head the report included definitions of "soft spot" and "water pocket"; the causes and means of preventing soft spots and water pockets; and detailed information as to the best ways of providing proper drainage in long cuts, in multiple-track territory and yards, and about passenger stations and highway grade crossings. Much of the information presented was a revision of material already in the Manual, which it was designed to replace. All of the material offered under this head was adopted.

Specifications for Pipe Line Crossings Under Tracks—The committee presented specifications covering the undercrossing of tracks by pipe lines carrying oil, gas, gasoline or other inflammable or highly volatile substances under pressure, or any substance which from its nature or pressure might cause damage if it should escape on or in the vicinity of railway property. These specifications, which are not presented here, were recommended for adoption and publication in the Manual.

Subcommittee Chairman P. T. Simons (M. P.) gave an extended account of the committee's dealings with the National Petroleum Institute, which had imposed strenuous objection to the adoption of the specifications, stating that the draft as submitted in the bulletin had been subjected to revision to meet the criticisms of pipe-line interests. W. F. Steffens (N. Y. C.) felt that the committee had gone too far, especially in eliminating the provision for valves on each side of the right of way, but the specifications were adopted as modified.

Portable Cribbing—The committee presented a detailed report on the use of portable cribbing in place of rigid retaining walls and of the utility of the different kinds of cribbing available. Essentially, the report was presented under the following heads: Definitions, materials, actual installations, failures, advantages, disadvantages, recommendations as to adaptability, wall design, unit design, unit manufacture, backfilling, and comparison of different types. With reference to crib walls of reinforced concrete, the committee reported that it has record of walls as long as 1506 ft. and as high as 28 ft. 6 in. Of the many installations reported, only two cases of failures were cited.

Following are the advantages of concrete crib walls over monolithic concrete walls, as set forth by the committee:

(1) They can be constructed in a restricted area without encroachment on adjoining property.

(2) They can be placed on foundation soils which would require piles or caissons under heavy mass walls. A slight settlement of foundation soil does not injure a properly designed and erected crib wall.

(3) They provide for drainage without the use of drain pipes and sewer connections.

(4) No forms, special equipment, or skilled labor is required in their erection.

(5) They require a minimum amount of foundation excavation. Under ordinary conditions the removal of the top soil to a depth of one foot is sufficient.

(6) No foundation masonry is required.

(7) They can be built in short sections, one or two cribs or cells at a time, the excavation being used as fill (where suitable) in the preceding crib. This reduces to a minimum the amount of shoring and falsework required and the consequent interference with traffic.

(8) These advantages collectively result in greater speed of erection and,

(9) Generally, lower cost.

(10) The embankment can be placed and the wall loaded immediately upon completion.

(11) Standardized precast units may be carried in stock for use in emergency.

(12) The units may be salvaged upon the removal of a wall and re-used elsewhere.

(13) A slight increase in the height of a wall may be made readily to take care of a minor bank widening or grade raise.

Offsetting these advantages, the committee pointed out the following disadvantages, which tend to restrict the use of crib walls.

(1) The crib members are not designed to carry the direct load of a train. The top sections of a crib wall must, therefore, be kept out from under the ties. For low walls this generally requires the use of more right-of-way than a solid wall, of which the base may project under the track and the top is narrower.

(2) The lack of a firm foundation may result in settlement and lateral movement which, if uneven, destroys the alinement either horizontally or longitudinally or both, with consequent injury to the appearance and possibly to the stability of the wall.

(3) Drainage through the face may be unsightly and, if the wall is on a property line, may be objectionable to the adjoining owner.

(4) The small cross-section of the members makes it imperative that the concrete be of the most durable quality, which is difficult to obtain, and that the reinforcing steel be carefully placed so as not to be too close to the surface.

Properties of Soils—Studying this subject from the standpoint of the effect on roadbed performance, the committee found that at present there is a dearth of accurate knowledge of the physical characteristics of soils, upon which may be based intelligent selection and rejection, correction of adverse conditions by economical means, and utilization of the maximum possibilities of the material at hand. It stated that it is undertaking a review of available data on this subject and will simplify, so far as possible, all of the information found on the behavior of various soil masses under the influence of pressure, moisture content and frost heaving.

Drainage Areas, Run-off, and Water Openings—Adding to run-off and flood flow data and formulas which it has presented in the past, the committee offered two more formulas covering flood flow, known as the Fuller formula and the Jarvis formula. In its conclusions, the committee repeated its previous warnings against the blind use of formulas, pointing out that the computation of run-off and water-way openings will always require the best judgment of experienced engineers, with careful attention being given to all information available, particularly local conditions.

In its recommendations, the committee expressed the belief that tables similar to the Dun table for Missouri and Kansas, as presented in Vol. 10, Page 977 and Vol. 12, Page 485 of the Proceedings, can best be compiled by individual railways for their own use, taking into account all experience gained in the territory served by them.

Correcting Soft Spots in Roadbed—The committee studied this subject only from the standpoint of where it is impractical to stabilize the roadbed by drainage. After pointing out the importance and broad scope of the subject, and the more general causes of wet spots and unstable roadway, the committee presented a number of remedies, with descriptions of treatment, other than drainage, which have proved successful. The treatments covered included the burning of splines on sliding banks, the rebuilding of fills, the flattening of slopes, dynamiting, the construction of retaining walls, and benching.

Width of Roadbed and Slopes of Banks—The committee expressed its belief that the question of width of roadbed cannot be answered definitely until discrepancies in the standard ballast sections shown in the Manual are eliminated. It recommended, therefore, that the subject of standard ballast sections be reassigned to the Committee on Ballast.

With regard to the slope of banks for cuts or fills, the committee reported that it had found no road which takes into consideration train loads or speeds in establishing slopes. It referred to a number of reports of growing instability of roadbed following the introduction of heavier locomotives or an increase in traffic, and stated that it was hard to understand how these factors could represent other than a contributing influence. In commenting on the future study of the subject, W. P. Wiltsee (N. & W.) urged that the committee keep in mind the thought that sub-ballast is ballast and not a part of the roadbed.

Drifting Snow and Snow Removal—This subject was reported on under the two heads, protection against snow and snow removal. Under protection against snow, the report discussed the removal of undesirable obstructions and the placing of desirable obstructions. The experience of several roads in the planting of shrubs and trees was presented, including the instructions issued on the Eastern lines of the Canadian Pacific for the planting of trees for snow fences.

Snow removal was discussed from the standpoint of conditions out on the line and in yards or terminals. The committee pointed out the desirability of keeping ahead of storms and of the importance of forethought and advance preparation to meet winter conditions.

Specifications for Fence Wire—The committee reported progress in the study of the service life of fence wire and outlined a number of tests with which it is in touch. It also presented chemical analyses of a number of samples of barbed wire which have been in service an unusual number of years, but stated that these analyses and the tests thus far do not justify definite conclusions at this time.

Overhaul in Grading Contracts—The committee made no report on this subject other than to recommend that its report of

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last year, submitted as information at that time, be adopted for publication in the Manual and affirmative action was taken to this effect.

Other Subjects—No revisions in the Manual were recommended, and the committee reported progress only on its assignment covering specifications for galvanizing metal pipe culverts.

Rules and Organization

E. H. Barnhart, Chairman*

Collaborating with appropriate committees, the Committee on Rules and Organization brought to the stage of definite recommendations a large number of rules for the guidance of employees in the maintenance of way department.

Maintenance of Masonry Bridges—The committee, with the approval of the committees on Masonry and on Iron and Steel Structures, offered the following rules for publication in the Manual:

1150—Driftwood or other debris must not be permitted to accumulate around the base of bridge masonry.

1151—All obstructions to proper drainage in the channel must be removed. If obstructions are caused by a faulty channel, they should be removed by changing the channel.

1152—Where any scouring or undermining of bridge masonry is found, riprap or other forms of protection must be installed.

1153—Where foundations are badly undermined or the relative elevation of the stream bed and the bottom of the masonry are not considered proper, the foundations should be lowered.

1154—Where examination reveals weakness of the masonry because of the undersize of the foundation, the dimensions of same must be increased as required for safe loadings.

1155—Where arches or culverts have been subjected to excessive scouring or undermining, additional protection should be provided in the form of paving, inverts, or apron or curtain walls.

1156—Where masonry is subjected to the action of ice or other abrasion causing disintegration, protection work of proper design must be installed and the masonry repaired.

1157—Where masonry is founded on timber, previously under water, which subsequently becomes exposed to the air, a proper masonry foundation must be substituted or the structure removed and rebuilt.

1158—Where movement has become restricted at expansion joints, these joints must be repaired to allow the joints to function as designed.

1159—Where failure of arch rings occurs, as indicated by cracks or the flattening of the arch, temporary support must be provided until permanent repairs can be made.

1160—Drains or "weep holes" in bridge masonry must be kept open to insure full operation of the drainage system.

1161—Inadequate drainage of bridge masonry should be remedied by the installation of drain tile or pipe.

1162—Bridge seats that have become weakened through deterioration or overload must be replaced with approved quality of reinforced concrete or granite masonry. Engineering plans to cover each case will be furnished.

1163—Areas of masonry that have become deteriorated must be repaired prior to reaching an extent endangering the strength of the structure. These areas must be repaired with good quality concrete, observing specifications for repairing deteriorating concrete.

1164—A stone or concrete structure showing deterioration over a large part of the surface, or which is otherwise structurally weak, must be rebuilt or reinforced by an encasement of good quality concrete in accordance with approved plans.

1165—Joints in stone masonry must be kept well pointed. Before pointing all loose material must be removed and the joints well moistened.

On objections by H. M. Church (C. & O.), the rules in this report were referred back to the committee for further study. Mr. Church objected to portions of rules 1151, 1152, 1155, 1156, 1157, 1161, 1162 and 1163 and to rules 1154 and 1164 in their entirety, saying that as presented these rules presupposed a knowledge of design and engineering on the part of maintenance forces.

Maintenance of Terminal Structures—Under the heading of turntables, the committee offered the four following rules for inclusion in the Manual:

1278—Turntables must be given close inspection at regular intervals.

1279—Careful maintenance must be given at all times by each department in charge of various units. The center pier must be kept level, firm and unyielding.

1288—Circle rails must be kept in correct surface and alinement.

1289—Track rails must be in good surface, anchored against end movement, and properly supported at the ends of the tables.

The following rule, under the heading of oil houses, was also recommended for adoption:

1299—Repairs must not be made with open flame lights, and in no case until investigation has been made to determine that there do not exist any oil or gas fumes.

The committee's recommendations that rules 1278, 1279, 1288, 1289 and 1299 be published in the Manual were adopted.

Rules for Fire Prevention—The committee presented as information a number of rules on fire prevention as applying to the maintenance of way department, these rules pointing out the specific duties of division engineers, supervisors of track, supervisors of bridges and buildings, and supervisors of water service. The rules were submitted with the approval of the National Board of Fire Underwriters, but the committee stated that by next year it hopes to be able to submit the rules for adoption with the approval of other interested bodies.

Titles for Assistant Engineers—In an attempt to clear up the confusion which surrounds at present the general term "assistant engineer," the committee presented a list of 19 appropriate titles for engineering assistants in various departments who are generally called assistant engineers. The list, which was compiled as the result of a questionnaire, and was not considered final, gives the duties of the positions, to whom report is made, and the proposed title.

Revision of Manual—The committee proposed a revised and simplified rule governing the report to be made by bridge inspectors in examining bridge structures or culverts, and recommended withdrawal of the existing rule designating the specific type of form to be used in reporting field inspections. In presenting this portion of the report, Mr. Barnhart explained that the committee had decided to withdraw its recommendation as it desired to give the matter further study.

*Industrial Engineer, Baltimore & Ohio.

Water Service and Sanitation

R. C. Bardwell, Chairman*

Seven of its nine assignments were reported upon by the committee in a rather condensed, yet comprehensive report.

Methods and Value of Water Treatment—After pointing out that there is no fixed rule for the character or extent of water treatment generally and that each installation must be made only after a thorough survey of each individual situation, the committee reiterated its belief in the value of the treatment of practically all natural waters used for steam generation and cited new evidence, obtained from actual observation, to substantiate its stand. Following is a summary of the characteristic replies which the committee received in answer to a questionnaire soliciting information concerning improvements attributable to water treatment:

(1) Records show that boiler work has decreased 50 per cent and that locomotives are no longer shopped for boiler work alone. Prior to correcting water condition the service was unreliable and it was often necessary to use two locomotives per train. Boilers were frequently washed every trip, whereas they now operate from 15 to 30 days.

(2) Prior to the installation of water treatment, scale and corrosion were very bad. Boilers were washed on some districts every 100 miles, whereas, they now operate from 400 to 1,000 miles before washout. Treatment has also decreased corrosion.

(3) The life of boiler material has increased over 100 per cent, with a reduction of 86 per cent in actual boiler maintenance costs since water treatment has been installed.

(4) Boiler maintenance reduction has amounted to over 80 per cent. Locomotive boiler failures have been practically eliminated and the government is allowing extensions of the time for tube renewals on many locomotives which have been operating the full four year allowance. Increased mileage between washouts results in a net saving of over $2,000 per month in labor costs alone.

(5) Estimate $1,000,000 per year saving due to water treatment.

(6) Ninety-five per cent of firebox renewals have been eliminated and the life of boiler flues has been extended over 200 per cent since water treatment has been installed.

The committee expressd its belief that, in spite of reduced wages and the reduced price of boiler material, and, at the same

*Superintendent Water Service, Chesapeake & Ohio.

time, in view of the large tangible savings being effected through water treatment, the figure of 13 cents saving per pound of scale removed from boiler water prior to its use is still conservative for estimating purposes.

Reporting Water Station and Treating Plant Operation—After reviewing the changes which have taken place in railway water service as a result of more intensive railway operation, the committee called attention to the forms which it has submitted previously for the tabulation of full information as to the cost of operation and other pertinent facts relative to the performance of each pumping station unit, and recommended again that these forms be used in the preparation of annual reports of station performance and also for the information of operating and other offices interested. It stated that, in addition to these tabulated statistics, it may be desirable, for a more complete report, to summarize briefly the results of the year's work; compare it with the previous year; show the estimated savings due to water softening and the savings accomplished by modernization of pumping plants; and to recommend improvements to be undertaken during the succeeding year.

Deep Well Pumping Equipment—Following a review of the development of deep well pumping equipment as used by the railways, including mention of recent improvements in this type of equipment, the committee offered the following conclusions:

(1) The types of deep well pumps now generally in use are the single or double-plunger displacement pump, the turbine pump, and the air lift.

(2) Displacement pumps may be considered for pumpages of 50 gal. to 300 gal. per minute and for varying depth of pump setting. Usually this depth should not be greater than 300 ft. The pump speed should not exceed 25 r.p.m. Overall efficiencies of this type of pump will vary from 40 to 60 per cent.

(3) The turbine pump may be considered for pumpages of 50 gal. to 6,000 gal. per min. and for lifts up to 500 ft. or more. This pump is undergoing rapid changes in design, size, and capacity, and its possibilities cannot be definitely stated at this time. Overall efficiencies of 60 per cent are obtained.

(4) The air lift may be considered for a wide range or pumpages and for settings of greater depth than might be suitable for other pumps. The air lift is more suitable than other pumps for installation in crooked wells or in wells which produce considerable quantities of sediment. There must be sufficient depth of water in the well to provide adequate submergence for the air lift under all pumping conditions. Overall efficiencies vary from 25 per cent to 40 per cent. No unusual developments in air lift pumping have occurred in recent years, except present-day forms of drive and power for the compressors, and the use of compound compressors for unusually deep wells.

(5) The type of installation can best be determined by a careful study of all local conditions, including probable operation and maintenance charges and interest and depreciation on the investment.

Analysis of Chemicals Used in Water Service—The committee presented standard methods for the analysis of hydrated lime and soda ash to be used in water treatment and recommended that they be adopted for publication in the Manual, which recommendation was approved.

Regulations Pertaining to Railway Sanitation—The report of the committee on this subject, which has to do with regulations imposed by Federal and State authorities, was a brief review of the report on railway sanitation, presented in November, 1931, by the Joint Committee on Railway Sanitation, A.R.A. The committee emphasized the scope and thoroughness of the report and expressed the feeling of its own members and those of the Joint Committee, that many of the economies and other advantages suggested in the report will be lost unless adequate provision for sanitary supervision is made by each individual road.

Sewage Disposal Where No Sanitary Facilities—After pointing out the importance of properly disposing of human waste and expressing its belief that proper sewage disposal is the greatest factor in influencing the general health of any group, the committee presented for the guidance of the railways descriptions of the various methods of sewage disposal where connections with sewage systems are not readily possible. Those methods described in greatest detail were septic tanks, cesspools, disposal by dilution or treatment, chemical toilets, septic toilets, pit privies and mobile units.

Revision of Manual—No important changes in the Manual were recommended, but the committee called attention to several minor errors and, furthermore, to the fact that its Tables 1 and 2, showing detailed weights and dimensions for various classes of cast iron pipe and fittings had been omitted. It recommended that these tables be included in their proper place. This recommendation was approved.

Other Subjects—Progress was reported in the study of the pitting and corrosion of boiler tubes and sheets and in the design and maintenance of track pans.

Economics of Railway Labor

F. M. Thomson, Chairman*

Of the nine subjects assigned to the committee, only four were reported on in detail, these having to do with standard methods for performing maintenance of way work; the use of motor trucks in the maintenance of way department; gang organization for performing maintenance of way work; and the effects of recent developments in maintenance of way practices on gang organizations.

Standard Methods of Performing Maintenance Work—Having studied this subject since 1920 with the view of establishing units of measure of work performed, the committee first reviewed all of its previous reports to the association and then offered a number of pertinent thoughts of the present committee membership. These are given in part in the following:

The two outstanding features to be considered are standard methods and time schedules for each item of work, and closer supervision by means of planning and dispatching of the work in advance.

In meeting the conditions now confronting the railways, it has been found that we can greatly curtail or dispense with many of the operations formerly considered essential. However, the time schedule still remains an important item, since without definite schedules, we will work with "hit-and-miss" methods that are not conducive to economy. Likewise, planning and dispatching are essential if we are to secure maximum efficiency, as any haphazard method of performing work, even on a small sub-division, will result in important items of work being delayed or omitted from the program.

It has been found that excellent results can be obtained from section forces by having all forces on a supervisor's district perform the same task on a given day. This, of course, requires a very close knowledge of conditions by the supervisor, but greatly reduces the time consumed in the operation.

In the bridge and building department scheduling is equally important, as these forces can consume a great deal of time in making miscellaneous repairs that may come to their attention in working over an assigned territory, and not be able to accomplish the more essential work on their schedule.

Motor Trucks in Maintenance Work—Based upon the results of a comprehensive survey to determine the extent to which automobiles and trucks have been utilized in engineering and maintenance of way work, the committee presented a general summary of its findings, abstracts from which follow:

While quite a number of railways have had successful experience with the use of trucks, other railways have decided that there is no particular advantage or benefit to them in their use. The economy in the use of this type of equipment seems to be largely dependent upon geographic location and traffic and, to a certain extent, local conditions. Under favorable conditions there appear to be very definite advantages and economies.

The conditions which appear favorable to auxiliary motor truck operation are:

(1) In and around terminals where traffic congestion results in frequent and long delays in the transportation of crews and materials by motor or hand car.

(2) When fixed property is located at some distance from the tracks and, therefore, inaccessible by train or motor car service.

(3) Around junction points where lines converge at small angles, or on paralleling lines where relatively short cross-country trips enable one crew to cover territory on more than one line.

(4) Lines which have paralleling highways, enabling maintenance crews to cover more mileage than could be covered with rail motor cars.

The use of motor trucks is, of course, not feasible for all of the various branches of railway maintenance. It is, however, practical in connection with certain phases of bridge and building work; water service; paint gangs; such forms of signal maintenance as the maintenance of highway crossing signals, flashers, etc.; telegraph and telephone maintenance; disposal of snow and other forms of storm debris; and for the transportation of survey and engineering crews, particularly when conditions obtain, as stated above.

In addition to the above, the report contained a list of the roads using automobiles and trucks in maintenance of way work, and also brief descriptions of the manner and extent to which such vehicles are used on several roads. The following conclusion was submitted:

Substantial economies may be realized under certain conditions by the use of motor vehicles in the performance of certain kinds of maintenance and engineering work.

Gang Organization and Maintenance Methods—In recognition of the fact that to ascertain the economics possible through the

*District Engineer, Missouri-Kansas-Texas.

use of mechanical equipment as compared with hand methods requires specific knowledge of the time necessary to perform the work by hand, the committee referred to the schedule for renewing rail out of face, appearing in the Manual, and then submitted as information additions to this schedule to cover changes which have been brought about by the use of 39-ft. rail and the increased number of ties per rail. It pointed out the inadvisability of attempting, at the present time to consider publishing in the Manual rail laying schedules covering the extensive use of mechanical equipment, but it offered as information studies showing the organizations, equipment and production records of rail laying operations on three roads, on which the type of track construction varied widely. These studies were made on the Central region of the Pennsylvania, on the Chesapeake & Ohio, and on the Louisville & Nashville.

The committee recommended that the subject-matter appearing in the Manual, beginning with Exhibit A on Page 1449, to and including the first three paragraphs on Page 1466, be withdrawn. This matter, in the form of exhibits, has to do largely with schedules or organizations for doing or reporting various classes of maintenance work. This recommendation was approved and the subject matter mentioned was ordered withdrawn from the Manual.

Effect of Recent Developments on Gang Organization—The report submitted by the committee supplements information given previously on this subject with respect to the Pennsylvania, the Chicago, Milwaukee, St. Paul & Pacific, the Boston & Maine, the Great Northern and the Missouri Pacific Lines in Texas and Louisiana, and includes a resumé of the practices on four additional roads—the Chicago, Burlington & Quincy; the Delaware, Lackawanna & Western; the Erie and the Lehigh Valley. Extensive reorganization of forces has been put in effect on all of these roads.

Other Subjects—The committee reported progress only on the following assignments:

Analysis of operations of railways that have made marked progress in the reduction of labor required in maintenance work; programming of bridge and building work; revised plans for outfit cars for maintenance of way department employees; economics of methods of weed killing.

Report on Buildings

A. L. Sparks, Chairman*

The Committee on Buildings again considered a large number of subjects, but this year presented detailed reports on only four subjects.

Specifications for Railway Buildings—Under this assignment, the committee offered for publication in the Manual (1) specifications for hydraulic elevators—baggage or freight, published in Vol. 31 of the proceedings of 1930; and (2) specifications for steel, brick and reinforced concrete chimneys, with addenda for draft gages, pyrometer and lightning protection, as published in Vol. 33, proceedings of 1932. Certain minor changes were recommended in the latter specifications. The committee offered, as information, newly prepared specifications covering electrically-operated freight or baggage elevators. The committee's recommendations in regard to this section of the report were adopted.

Heating Small Railway Buildings—The committee, after pointing out the desirability of providing adequate heating systems in railway buildings and the many factors which should be considered in selecting the type of heating apparatus, presented descriptions of the three general classes of apparatus or systems generally suitable, together with the advantages and disadvantages of each type in each class. The first of these classes included various types of stoves. The second class included warm air furnaces and steam and hot air systems; coal, gas and oil fired. The third class included unit fans heated by various means, and direct-fired gas and oil heaters. The committee recommended that this subject be discontinued.

Fruit and Produce Terminal Buildings—Starting its study on the theorem that modern fruit and produce terminal buildings should be designed and built for the service and convenience of both the shipper and buyer, and be provided with suitable facilities for receiving, housing, storing and displaying perishable farm and garden products, and for the proper and prompt handling of shipments of fruits, vegetables, and in some cases, butter, cheese, eggs, poultry, dressed meats, groceries and canned goods, the committee discussed the types of layouts and construction available, the facilities required or desirable, and details of design and fitting of special areas to afford the greatest convenience and efficiency in operating the terminal. Special attention was given to banana rooms, poultry platforms, refrigeration, drainage, heating and lighting. It was recommended that the subject be discontinued.

Building of Other Than Brick, Stone and Cement Construction—Recognizing the demand, for any of a number of reasons, for buildings of less expensive or less permanent construction than brick, stone or cement, the committee called attention to other types of construction available for exterior walls, interior side walls, interior fixed partitions, movable office partitions, floors and ceilings. It then discussed these various types of construction from the standpoint of fire-resisting qualities, space occupied by materials of construction, heating conditions, sound absorption, size and weight of framework, and relative cost. It recommended the subject be discontinued.

Other Subjects—Other subjects considered by the committee, but on which no detailed reports were made, were: Remodeling freight houses for accommodation of truck door-to-door delivery of freight; bus terminal buildings, isolated and in conjunction with railway stations; application of stainless and rust-resisting steels to building construction; vermin and rat-proofing of buildings; relative merits of wood and fire-proof roof structures; and causes and prevention of dust explosions in grain elevators.

* Architect, Missouri-Kansas-Texas Lines.

Economics of Railway Operation

J. E. Teal, Chairman*

Only two of its assigned subjects were reported on by the committee this year, but these quite comprehensively and in considerable detail. Progress was reported on six other assignments.

More Intensive Use of Facilities—Under the specific assignment of studying methods for obtaining more intensive use of existing railway facilities, with particular reference to securing increased carrying capacity, the report of the committee this year was, through an example, worked out in complete detail, a forecast of the economies that may be expected by the installation of a modified centralized traffic control system for controlled manual block operation of a single-track railroad equipped with short sections of double track with spring switches.

As a result of its studies, the committee offered the following conclusions:

Where the distribution of traffic on existing lines results in considerable overtime under timetable, train order, and manual block system, consideration should be given to a rearrangement of tracks by eliminating passing sidings, providing short sections of double track, and installing a system of C. T. C. controlled manual block for directing train movements by signal indication, which will provide:

(1) Reduction in overtime by eliminating excessive delays and stops at meeting and passing points, shorter block lengths, reduction in running time, and a reduction in the number of water stops. (2) Increased track capacity. (3) Increased train load. (4) Increased safety in train operation. (5) Increased flexibility of operation by directing train movements by signal indication. (6) Reduction in transportation expense.

Most Economical Train Length—Because of the numerous factors which enter into the problem of determining the most economical train length, the committee deemed it necessary to begin its study by classifying as many factors as possible into groups and then, from a study of the various groups, to determine what effect each group has on the final results. It pointed out that for any particular case there will be a number of conditions in each group which can be considered more or less fixed, and a number of conditions which can be varied. By substituting various values for the variable conditions, it said, the effect of these variations can be determined for the different groups, and by considering the effect of all the component groups it is theoretically possible to find a set of conditions which will show when the greatest economy has been reached.

The factors requiring consideration in a determination of the most economical train length were grouped as follows: Those having to do with track capacity; those having to do with motive power capacity; those having regard to capital investments; and those having to do with operating and maintenance expense. Most of the report was confined to those factors having to do with motive power capacity.

As a part of its report, the committee presented an exhibit, (A), on locomotive development, the purpose of which was to present notes in regard to the fundamental principles of locomotive traction to show how a number of factors pertaining to motive power can be so correlated as to simplify the solution of some of the operating problems which depend upon them. The exhibit discussed the trend in the construction of new locomotives,

* Special Engineer, Operation, Chesapeake & Ohio.

and also brought out relations in regard to rated horsepower capacity per ton, boiler capacity, weight on drivers and tender weights, which were used in the discussion presented in the report proper.

Other Subjects—The subjects on which progress was reported are as follows: Revision of the Manual; methods or formulas for the solution of special problems relating to more economical and efficient railway operation; the most economical makeup of track to carry various traffic densities; the effect of volume of traffic on railway operating expenses; discontinuance of non-paying trains and agencies; and operation with reduced number of main tracks.

Commenting on the work of the committee, E. F. Wendt (consulting engineer) cited figures to demonstrate the increased efficiency of railway operation, without which the loss of net revenues resulting from the unprecedented decrease in traffic would have been far greater than they have been.

Report on Grade Crossings

J. G. Brennan, Chairman*

Among the important contributions of the committee this year were the submission of drawings for several signs, and the presentation of the results of investigations relative to the practices of the different states governing the division of costs of highway grade separations, and with regard to dimensions and clearances called for in the construction, protection, elimination and separation of grades at railroad-highway grade crossings.

Revision of Manual—The committee dealt with five subjects under this assignment. Relative to the proper lighting at the base of signals located in the center of highways, it recommended that no change be made in the present standard.

Co-operating with the Signal Section, A. R. A., the committee reported that detailed plans had been prepared for the following: "Number-of-Tracks" sign, both painted and with reflector lenses; crossbuck sign, both painted and with reflector lenses, for use in connection with flashing-light or wig-wag signals; "Stop on Red Signals" and "Stop-When-Swinging" signs, illuminated by means of reflector lenses; adapter clamp and details for signs; reflector crossing signal marker; and numerals for track signs. It recommended that these drawings be endorsed as standard by reference. All of these recommendations were approved.

The committee also presented plans for the illumination of the crossbuck sign by means of reflector lenses, which plans it recommended for adoption, and advised that A. R. A. Signal Section specifications have been prepared covering the construction of signs of various designs. It recommended that these specifications, included in the report as an exhibit, be adopted as standard by reference.

Relative to the standard design of the crossbuck sign, the committee recommended that the specified angle of 50 deg. between blades be omitted.

Laws and Regulations Affecting Construction, Protection, Elimination and Separation of Crossings—From a questionnaire sent to the highway departments of the different states, the District of Columbia, and the Canadian provinces, the committee gathered a large amount of information relative to the laws, regulations and practices governing primarily dimensions and clearances required in the construction, protection, elimination and separation of grades at railroad-highway crossings. This information was presented to the association as information in tabular form.

Division of Costs of Grade Separations—Under this assignment the committee compiled a summary of the laws and practices of the different states relative to the division of costs of grade separation projects, which it presented in both statement and tabular form. In addition, it outlined the practices in certain states wherein matters relative to grade separations are covered by working agreements not authorized by the state legislature. A long discussion followed the presentation of this part of the report, during which R. H. Ford (C. R. I. & P.) urged that the committee undertake an exhaustive study along the lines of engineering research to determine the proper division of cost of grade separations, based on relative use by the various forms of transportation.

Drainage, and Costs Thereof, in Grade Crossing Elimination Projects—In a brief report, the committee said: It is the sense of the committee that drainage methods for grade crossing elimination projects are engineering details to be considered in connection with each individual project. Furthermore, that the division of costs chargeable thereto is a problem that must be determined as part of the division of costs of the entire project.

Concave Street Sections for Subways—Under this assignment the committee discussed the relative advantages of a concave street section in subways brought about by grade separations, and also the transition from a convex or crown section to a concave section. Relative to the concave section itself, the committee said, in part, as follows:

While the difference in elevation between the convexity and concavity of cross sections is at most a matter of inches, this difference assumes economic importance because it influences the major elements of cost. Drainage structures, notably the lengths and number of sewer connections and the number of catch basins, are minimized, while the separation of the grades and general extent of the work are favorably affected. The concave section is of distinct advantage at street intersections located within subway approach limits, because the concavity forms a desirable valley with which the descending grades of the cross streets may be connected without reverse vertical curves. This arrangement tends to simplify the drainage as well as the pavement warping.

Stock Guards—Types, Uses and Necessity For—The report on this subject was a summary review of the practices of roads in different parts of the country relative to the use of stock guards, including a general statement of the more common types of guards in use. It was pointed out that, because of changed conditions, the use of stock guards is being quite generally discontinued throughout the northern and eastern sections of the country, while in the South and Southwest, their use is still common practice.

Other Subjects—Progress was reported on the study of the following subjects: Economic aspects of grade crossing protection in lieu of grade separation; standard specification for street crossings over railway tracks; and highway crossing planks and substitutes therefore. In connection with the last mentioned subject, the committee recommended that further study of the subject be conducted under the assignment, "Study the types and relative economy of different types of highway crossings, collaborating with the committees on Roadway and Track."

Report on Masonry

Meyer Hirschthal, Chairman*

Five subjects were reported on in more or less detail by the committee this year, the most definite recommendations being with regard to the method of repairing deteriorating concrete, for which specifications were presented for adoption.

Specifications for Repairing Concrete—As a result of the cumulative study which the committee has given to the repair of deteriorating concrete, it presented last year, for information, specifications for the repair of such concrete. This year the specifications were submitted for adoption and publication in the Manual. The specifications offered apply to repairs to concrete made necessary or advisable by causes other than foundation failure or overload, and cover patching and the restoration and encasement of structures or parts of structures. In detail, they are set up under the following main heads: General, materials, water ratio and consistency, reinforcement, anchorage, preparation of bonding surface, application of new concrete, curing and protection, and encasement. These specifications were adopted with one minor change.

Concrete- Specifications and Principles of Design—The committee stated that it was not in a position yet to present specifications for the design of reinforced concrete structures as rigid frames, but, bearing on this subject, it presented a comprehensive monograph on "Rigid Frame Bridges," prepared by Hardy Cross, one of its members, professor of structural engineering, University of Illinois. As a part of its report, it also presented, as information, a series of drawings covering a design for a ballasted deck reinforced concrete trestle. In addition, the committee offered a number of revisions of the specifications for concrete appearing in the Manual. It reported progress on the subject of specifications for concrete arches.

Concrete Manufacture—The report this year on progress in the science and art of concrete manufacture dealt solely with proper curing. Following a discussion of this phase of the subject, with special reference to steam curing, chemical applications and various coatings, the committee offered the following conclusions:

(1) Proper curing is one of the most important single factors in obtaining the desirable qualities of concrete.

(2) The relative value of any method of curing depends upon its effectiveness in controlling temperature and in preventing loss of water from the mass during the curing period. Continuous moist curing with temperature control is a preferred method.

(3) Surface coatings that prevent loss of moisture are in

* Engineer of Grade Crossings, New York Central.

* Concrete Engineer, Delaware, Lackawanna & Western.

general effective. Black coatings that absorb the sun's rays should preferably be covered with white material.

(4) Proper curing is essential to develop impermeability of concrete made by ordinary methods. Tests indicate that concrete of a workable consistency made with six gallons or less of water per sack of cement, and placed without segregation, will be watertight after 7 days of moist curing at 70 deg. F.

Expansion Joints—The committee submitted, for information, 21 sketches covering various types of expansion joints involved in masonry structures. These were taken from plans collected from a number of roads.

Revision of Manual—The committee proposed changes in or additions to nine articles of the specifications for plain and reinforced Portland cement concrete, appearing in the Manual. These changes and additions were adopted after amendment of one of the articles submitted.

Other Subjects—The committee reported progress on its contact with the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete; and also in its study of specifications for foundations, and of methods and practices of lining and relining tunnels.

New Officers

The following officers were elected to serve for the ensuing year: President, W. P. Wiltsee, chief engineer, N. & W., Roanoke, Va.; second vice-president, Robert H. Ford, assistant chief engineer, C. R. I. & P.; secretary, E. H. Fritch (re-elected); treasurer, A. F. Blaess (re-elected), chief engineer, I. C.; directors, Lem Adams, chief engineer, U. P., G. S. Fanning, chief engineer, Erie; W. F. Cummings, assistant chief engineer, B. & M.; members of Nominating committee, H. R. Clarke, engineer maintenance of way, C. B. & Q., J. R. Watt, engineer maintenance of way, L. & N.; E. W. Caruthers, assistant engineer, Penna.; E. R. Lewis, principal assistant engineer, M. C.; F. L. Nicholson, chief engineer, Nor. Sou. In addition, J. E. Armstrong, assistant chief engineer, Can. Pac., moved automatically from second vice-president to first vice-president.

N. R. A. A. Annual Meeting

THE annual meeting of the National Railway Appliances Association was held in the offices of the association, 910 South Michigan avenue, Chicago, on Monday, March 13, with President Frank E. McAllister, Kalamazoo Railway Supply Company, in the chair. Reviewing the work of the past year, Mr. McAllister described the steps which had been taken to maintain the identity of the organization, while at the same time reducing the expenses to the minimum. This action had been taken, he stated, in the belief that the railway industry is a permanent industry and that the railway supply industry is no less permanent.

C. W. Kelly, secretary, reported that in spite of the fact that no exhibit was presented last year, 64 railway supply companies continued their support of the organization through membership and that approximately the same number have indicated their intention of doing so during 1933.

Election of Officers

The following officers were elected for the ensuing year: President, Alex Chapman, Rail Joint Company; first vice-president, W. Homer Hartz, Morden Frog & Crossing Company; treasurer (re-elected) C. W. Kelly; directors (one year) Robert D. Sinclair, Fairmont Railways Motors, Inc., (two years) James O'Leary, Jr., Johns-Manville Corporation, (three years) A. L. McNeill, Okonite Company, and Lucius B. Sherman, *Railway Age*. At a meeting of the newly-elected board of directors, immediately following the adjournment of the annual meeting of the association, Mr. Kelly was appointed secretary and director of exhibits.

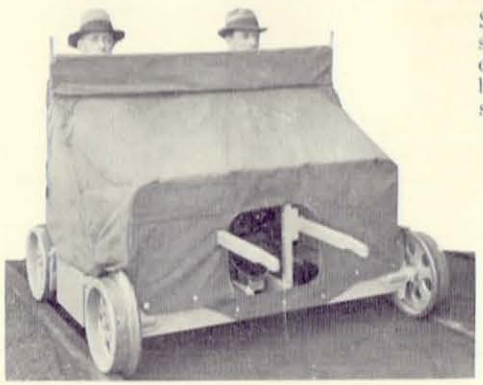
* * * *

A Canadian National Train in the Rockies

Manufacturers Offer Aid

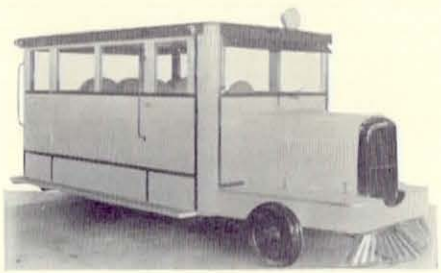
Period of business inactivity utilized to improve old products and devise new ones

Motor Cars, Large and Small



STORM ENCLOSURE for small inspection cars. Covers entire front end of car with sides enclosed by flaps which fasten at rear of seats. FAIRBANKS, MORSE & CO.

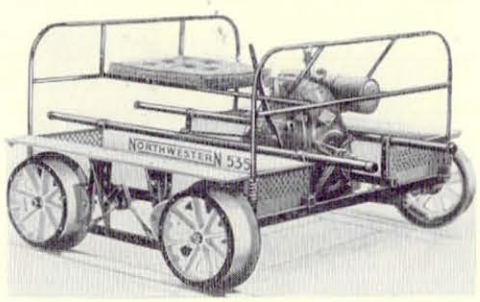
INSPECTION CAR for one or two men. Total weight 425 lb. Frame and many other parts of aluminum alloy. Model M9. FAIRMONT RAILWAY MOTORS, INC.



OFFICIAL INSPECTION CAR, having two doors at both front and rear, wicker bus-type seats for nine persons, upholstered in leather, front and rear glass windows extending practically the width of car. KALAMAZOO RAILWAY SUPPLY COMPANY.

TWO RAIL COACHES: Models 6100 and 5100, having wide choice of seat plans and interior furnishings. Six-cylinder engines, Westinghouse air brakes, four-speed transmission and reverse gear making all four speeds available for running backward. FAIRMONT RAILWAY MOTORS, INC.

OFFICIAL INSPECTION CAR with controls at both ends, stream-lined body, powered with 120-hp. gasoline engine. All moving parts mounted on roller bearings. BUDA COMPANY-COACH & CAR EQUIPMENT CO.



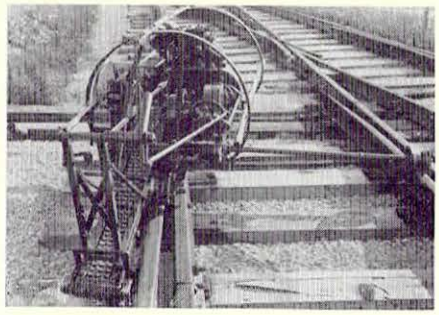
FOUR LIGHT MOTOR CARS: Type 532 for general service; Type 533 for signal and patrol work; Type 534 for section service; Type 535 for one-man inspection service. Illustration shows Type 535 car. NORTHWESTERN MOTOR COMPANY.

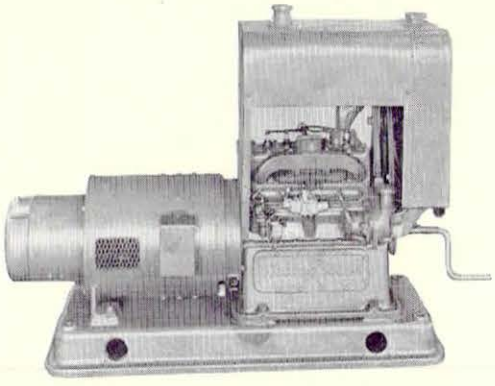
in Solving Problems of 1933

A pictorial exhibit of new products that are designed to reduce maintenance costs

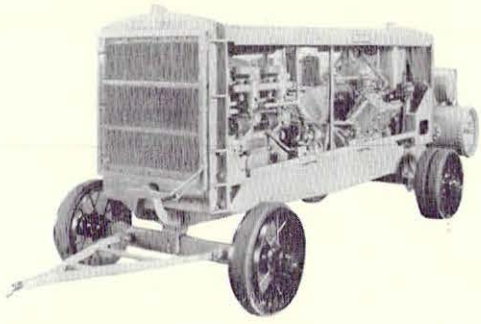
Power Tools and Power Plants

POWER TRACK WRENCH mounted in hoop frame on flanged rollers with guide arm to opposite rail. Wrenching action applied from end of wrench arm, which reaches nuts on both sides of rail with one setting of machine. NORDBERG MANUFACTURING COMPANY.



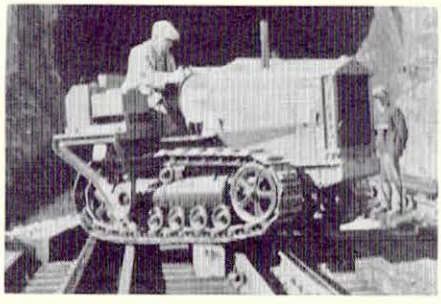


5 KV-A., 3-PHASE, 60-CYCLE GENERATOR. One of a series, including other 3-phase units, as well as single-phase alternating and direct current generators, available in various capacities and voltages. WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY.



PORTABLE COMPRESSOR, of 505 cu. ft. Distinguished from other Sullivan compressors by two-stage compression. Known as Model WK-314. SULLIVAN MACHINERY COMPANY.

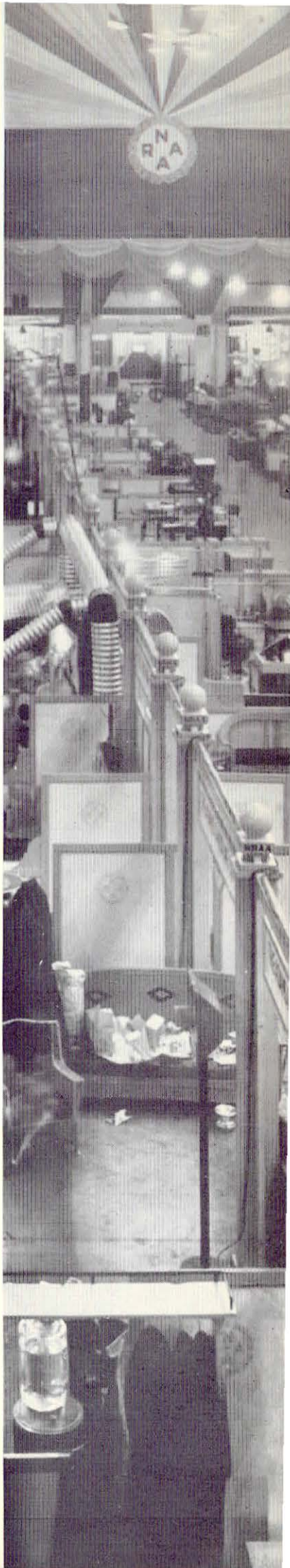
CLETRAC TRACTORS, available with welding and grinding generators, air compressors, snow plows, rotary brooms, crane booms, etc. Illustration shows tractor with General Electric 300-ampere welding generator mounted on side. GENERAL ELECTRIC COMPANY-CLEVELAND TRACTOR COMPANY.



ROCK DRILL BIT with threaded connection to the steel. Permits ready replacement of worn bits. TIMKEN ROLLER BEARING COMPANY.

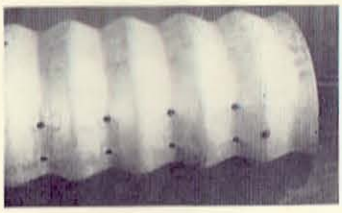
SLOTTING GUIDE for use with cross-grinder. Consists of roller-mounted carriage mounted on frame that clamps to rail. Carriage carries grinder wheel and is moved back and forth laterally until slot is ground to desired depth. NORDBERG MANUFACTURING COMPANY.

COMPRESSOR MOUNTING consisting of self-propelled rail-car with transverse wheels for removing from track. Available for 120, 180, 240 and 360-cu. ft. standard compressors. SCHRAMM, INC.



Bridge and Building

INTERLOCKING ROOF PLATES of cast iron, 24 in. wide, 52 in. long and about 3/16 in. thick, weighing 75 lb. each. Weight of finished roofing 10.8 lb. per sq. ft. Known as Usicast roof. UNITED STATES PIPE & FOUNDRY CO.

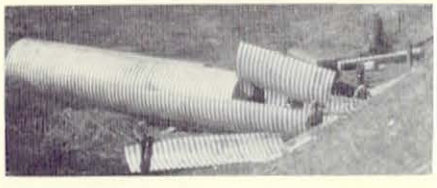


PERFORATED CORRUGATED IRON DRAIN PIPE: Now available with narrow invert paving to afford protection against erosion. ARMCO CULVERT MANUFACTURERS ASSOCIATION.

WEIGHT RECORDER: Mechanical weight recorder, and automatic electric recording unit which can be applied to one or a battery of scales. FAIRBANKS, MORSE & CO.

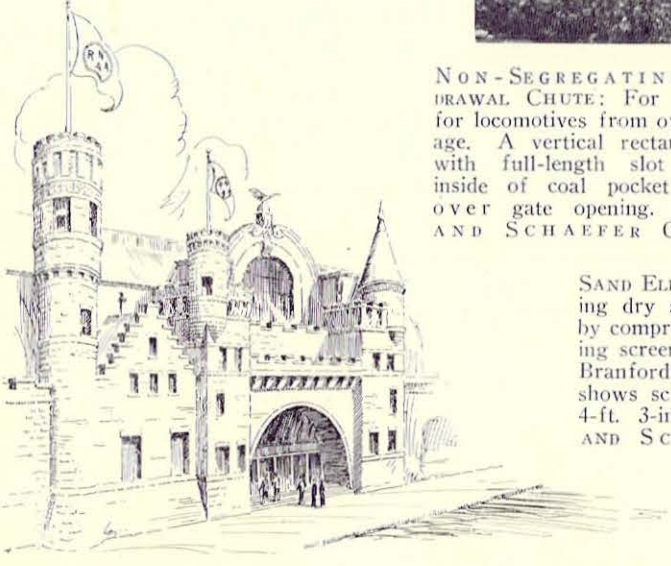
PHOTOLUX LIGHTING CONTROL, for control of yard flood lights. Automatically turns lights on when daylight decreases and vice versa. WESTINGHOUSE ELECTRIC & MANUFACTURING CO.

ROOFING AND SIDING of wrought iron, galvanized and corrugated. Illustration shows men applying roof to building in which all roofing, siding, ventilators, flashing and skylights are of wrought iron. A. M. BYERS COMPANY.

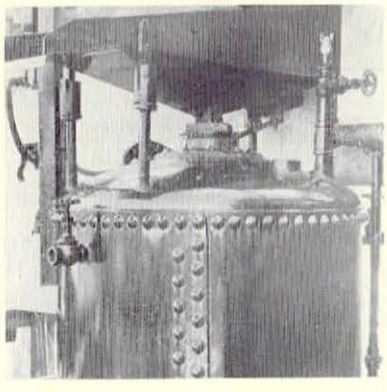


MULTI PLATE PIPE, a form of corrugated iron pipe, made in sections and assembled in the field by bolting 6, 7, 8 or more plates together to form pipe of 90-in., 100-in., 120-in. or larger diameter, respectively. ARMCO CULVERT MANUFACTURERS ASSOCIATION.

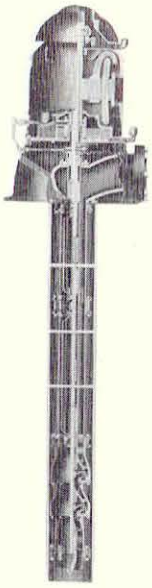
NON-SEGREGATING WITHDRAWAL CHUTE: For mixing coal for locomotives from overhead storage. A vertical rectangular chute with full-length slot applied to inside of coal pocket directly over gate opening. ROBERTS AND SCHAEFER COMPANY.



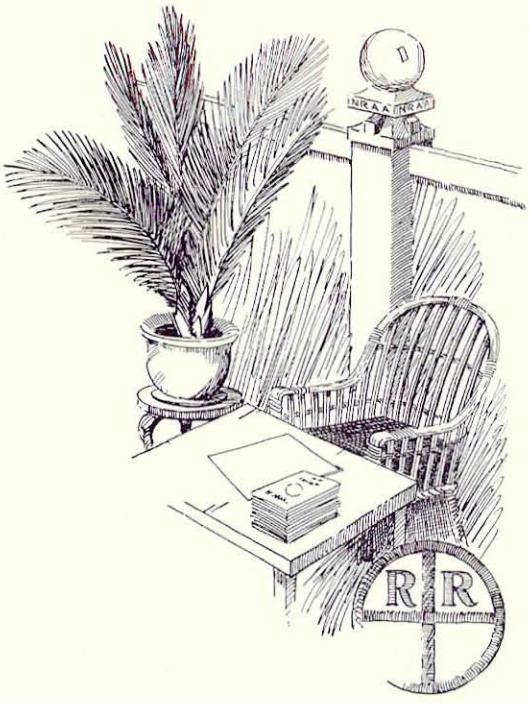
SAND ELEVATING DRUM for elevating dry sand to overhead storage by compressed air Utilizes vibrating screen 36 in. long, agitated by Branford air vibrator. Figure shows screen attached to 3-ft. by 4-ft. 3-in. sand drum. ROBERTS AND SCHAEFER COMPANY.

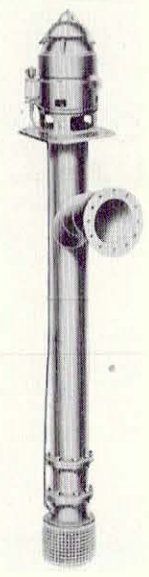


For Water Service

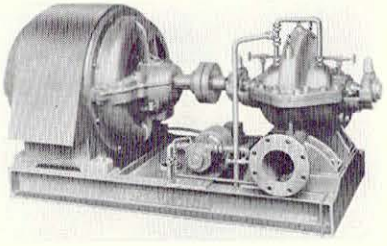


DEEP WELL TURBINE PUMP, Type WP, having flanged column and enclosed pump shaft. Built for either oil or water lubrication. A. D. COOK, INC.



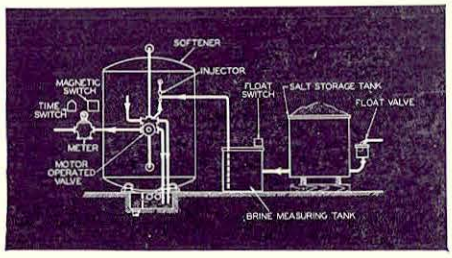


PROPELLER PUMPS, designed to meet need for efficient handling of large quantities of water at low heads. For use in land drainage, storm-water disposal and unwatering of excavations and coffer-dams. FAIRBANKS, MORSE & CO.

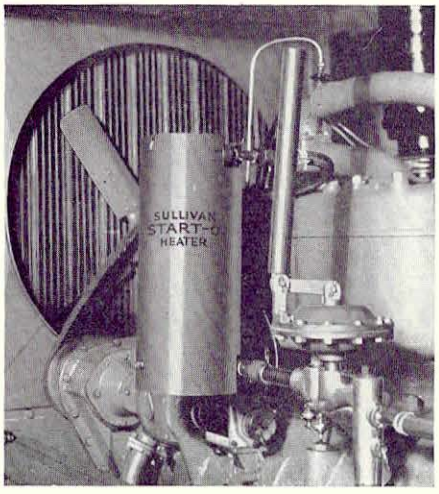


CENTRIFUGAL PUMPING UNIT, self-contained and automatically primed. Consists of electrically driven ball-bearing pump mounted with motor on fabricated steel bed plate, together with Monobloc priming unit. WORTHINGTON PUMP & MACHINERY CORP.

CONCENTRATION HYDROMETER, for accurate determination of locomotive boiler water concentration. Provides for all observations, temperature corrections and tabular references. DEARBORN CHEMICAL COMPANY.



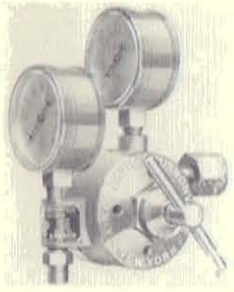
AUTOMATIC ZEOLITE TREATMENT: Afforded by new plant in which electrical controls actuate successive steps of back washing, regeneration, rinsing, and restoration to normal service. THE PERMUTIT COMPANY.



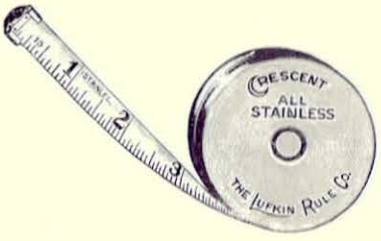
HEATER, for facilitating starting of gasoline-engine driven portable air compressors in cold weather. Consists of oversize heating coil enclosed in cylindrical housing, with diaphragm pump for circulating heated water through cooling systems of engine and compressor. Known as Start-O heater. SULLIVAN MACHINERY COMPANY.

Track

TYPE MB MECO rail and flange lubricator, improved to permit quicker handling of heavy lubricants in freezing weather. MAINTENANCE EQUIPMENT COMPANY.



AIRCO TWO-STAGE REDUCTION OXYGEN REGULATOR, which is non-freezing and non-fluctuating, designed for use in all classes of oxy-acetylene welding and cutting work. AIR REDUCTION SALES COMPANY.



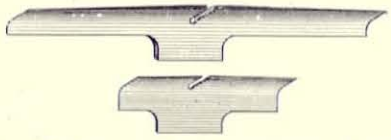
SIX-FOOT TAPE-RULE made of stainless steel, graduated in inches and sixteenths; with one edge in feet, tenths and hundredths if desired. Known as all-stainless Crescent No. S-696. LUFKIN RULE COMPANY.

WELDED RAIL BOND for signal track circuits. AMERICAN STEEL & WIRE COMPANY.

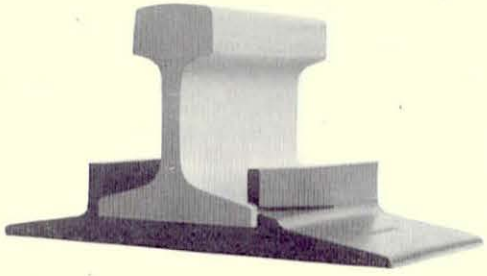
METHOD OF TESTING TRACK TOOLS. Tools are given electromagnetic charge so that when covered with powder containing fine iron dust this dust clings to metal along edges of flaws. Illustration shows how flaw in track chisel was brought to light. WOODINGS-VERONA TOOL WORKS.

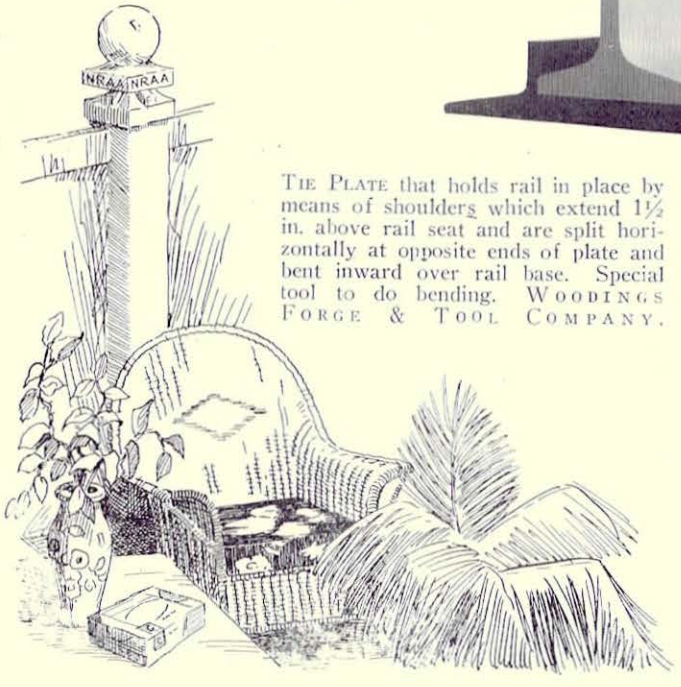
TRIFLEX SPRING for track bolts, consisting of high-carbon forging in form of flat arch with short reverse curve at crown. So proportioned that bolt tension of 20,000 lb. will bring convex portion into contact with angle bar. WOODINGS-VERONA TOOL WORKS.

LAMINATED PLUG-TYPE SIGNAL RAIL-BOND applied to head of rail. RAILROAD ACCESSORIES CORP.



JOINT SHIMS in three new sizes, giving total of seven sizes differing in center thickness by 2/100 in. Drop lug made to fit closely between center bolts of joint. Top of shims notched 7/16 in. at center to prevent rail ends from contacting this portion. AMERICAN FORK & HOE COMPANY.

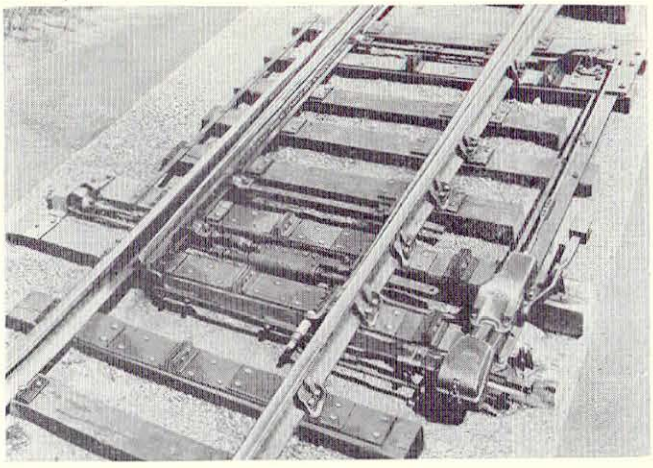


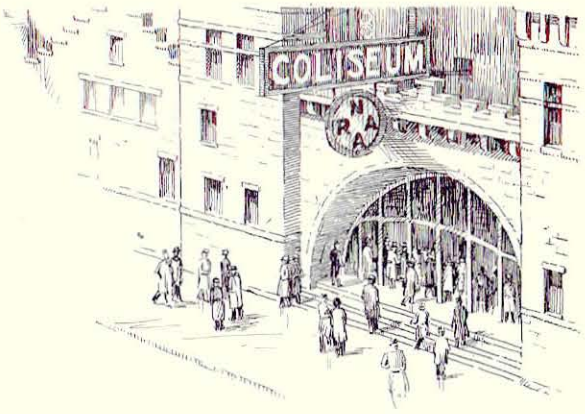


TIE PLATE that holds rail in place by means of shoulders which extend 1½ in. above rail seat and are split horizontally at opposite ends of plate and bent inward over rail base. Special tool to do bending. WOODINGS FORGE & TOOL COMPANY.

HEAT-TREATING process for running surface of rails at joints. Embodies application of electric arc and controlled oil quenching. Illustration shows heater used. ELECTRIC RAILWELD SALES CORPORATION.

Signaling

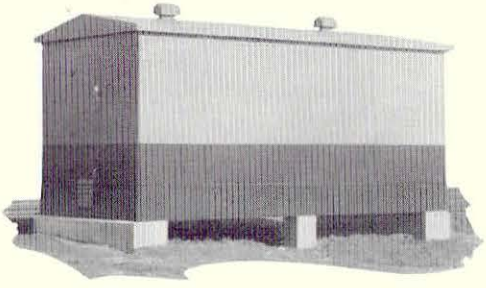




MECHANICAL FACING-POINT lock for spring switches, operated by first set of wheels trailing through. UNION SWITCH & SIGNAL CO.

KEEPALITE, a self-contained power unit for emergency lighting. ELECTRIC STORAGE BATTERY CO.

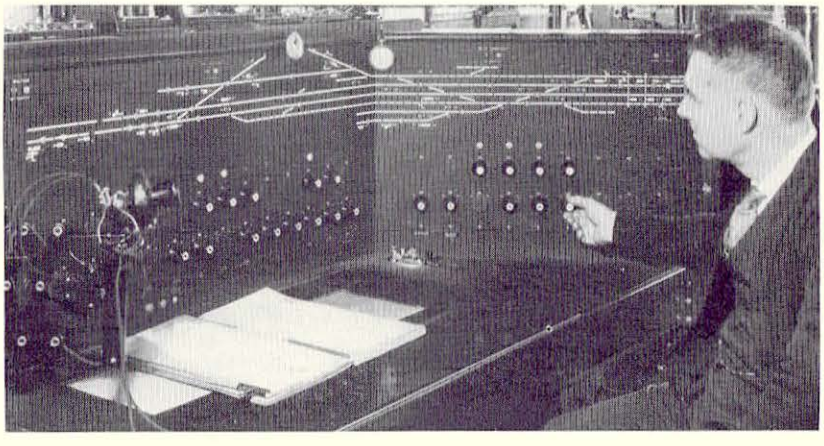
HIGHWAY CROSSING SIGNAL with button-type reflector signs conforming to A. R. A. Joint Committee standards. UNION SWITCH & SIGNAL CO.



WELDED STEEL HOUSES for signaling control equipment and batteries. GENERAL RAILWAY SIGNAL CO.

HIGHWAY CROSSING SIGNAL of flasher-light type with independent back lights. WESTERN RAILROAD SUPPLY CO.

MOTOR-DRIVEN SELECTOR KEY for telephone train dispatching calling equipment. WESTERN ELECTRIC CO.



DESK-TYPE MACHINE for centralized-control type of interlocking. GENERAL RAILWAY SIGNAL CO.

The Way to Operating Economies

DURING the past few years, necessity has caused the railways to look more and more to lower costs for the solution of their problems. They have found that a greater utilization of modern appliances, materials and equipment is the way to operating economies in many phases of railway work. In fact, the results achieved on specific railroads give proof that modern methods and equipment are extremely important factors in reducing operating expenses.

Since heavier traffic places a greater burden on existing railway facilities, it is apparent that modern methods and equipment will be of even greater importance as the volume of traffic increases. The increase in operating income resulting from increased traffic will make possible a greater volume of purchases of modern appliances, materials and equipment, and consequently the opportunity for achieving further economies and efficiency will be greatly increased.

Because it is of paramount importance that the railways strive continuously to secure maximum operating efficiency and economy, the *Railway Age* features regularly in its text pages, case studies of the utilization of modern methods and equipment, and manufacturers feature, in the advertising pages, the merits of their modern and improved equipment and materials which offer further economy and efficiency in railway work. Messages of this nature from a number of manufacturers appear on the following pages.

Shoulder to Shoulder With You Now «and Without Interruption Since 1887

Dearborn

represents continuous economy and effectiveness in Water Treatment

The railways employing Dearborn Service have come to know that Dearborn has always worked for maximum economies in locomotive boiler operation. The present strenuous times find Dearborn still shoulder to shoulder with those they serve, producing by the use of proper methods and materials full measure of steam power for every gallon of water evaporated.

Complete control of water troubles is the only successful result we recognize. Such result is dependent upon

Constant research,
Full understanding of operating problems, and
Development of the most effective treating materials for the individual case.

These are the reasons for making analyses of water supplies in Dearborn Laboratories and a study of operating conditions before submitting recommendations. These are the reasons for the constant laboratory control in checking boiler conditions.

This water treatment service enables Dearborn users to produce power at minimum cost, and to save money on lubrication, repair and replacement costs. We offer you this service for reliable control of scale formation, foaming, pitting, corrosion and embrittlement in your locomotive boilers. Half gallon samples of water supplies required for analysis.

Dearborn Special Formula No. 134

Rapid, Thorough Removal of Scale

When Diesel engine jackets, water lines, boilers, heaters, condensers and general water handling equipment build up scale, under conditions where it is not practical to treat the water, the scale should be removed periodically to maintain efficiency and capacity. For fast, thorough removal of carbonate scale, Dearborn Special Formula No. 134 is unsurpassed. It may be used, mixed with water, as a spray in locomotive boilers that have scale deposits. It is surprising the amount of scale a few minutes spraying removes Recommendations submitted gladly.

DEARBORN CHEMICAL COMPANY
310 S. Michigan Avenue, CHICAGO 205 E. 42nd Street, NEW YORK
Canadian Office and Factory: Toronto

The Combustion Chamber SYPHON for Safety

The Combustion Chamber
SYPHON
HAS PROVEN ITS VALUE AS A
Safety Device

Reproduced from the Railway Age May 26, 1928

The Combustion Chamber
SYPHON
Has AGAIN Proved Its VALUE as a
SAFETY DEVICE

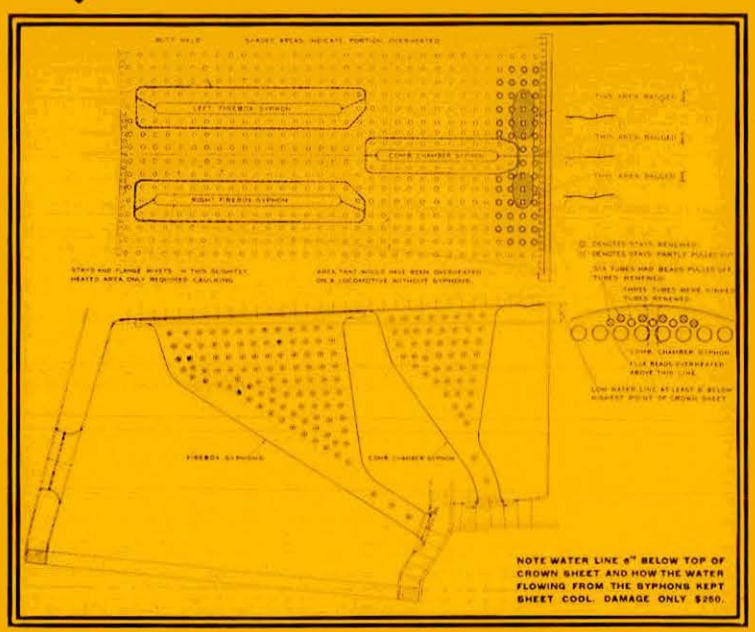
Reproduced from the Railway Age May 28, 1931

For the Third Time—
The Combustion Chamber
SYPHON
Has Proven Its Value as a
SAFETY DEVICE

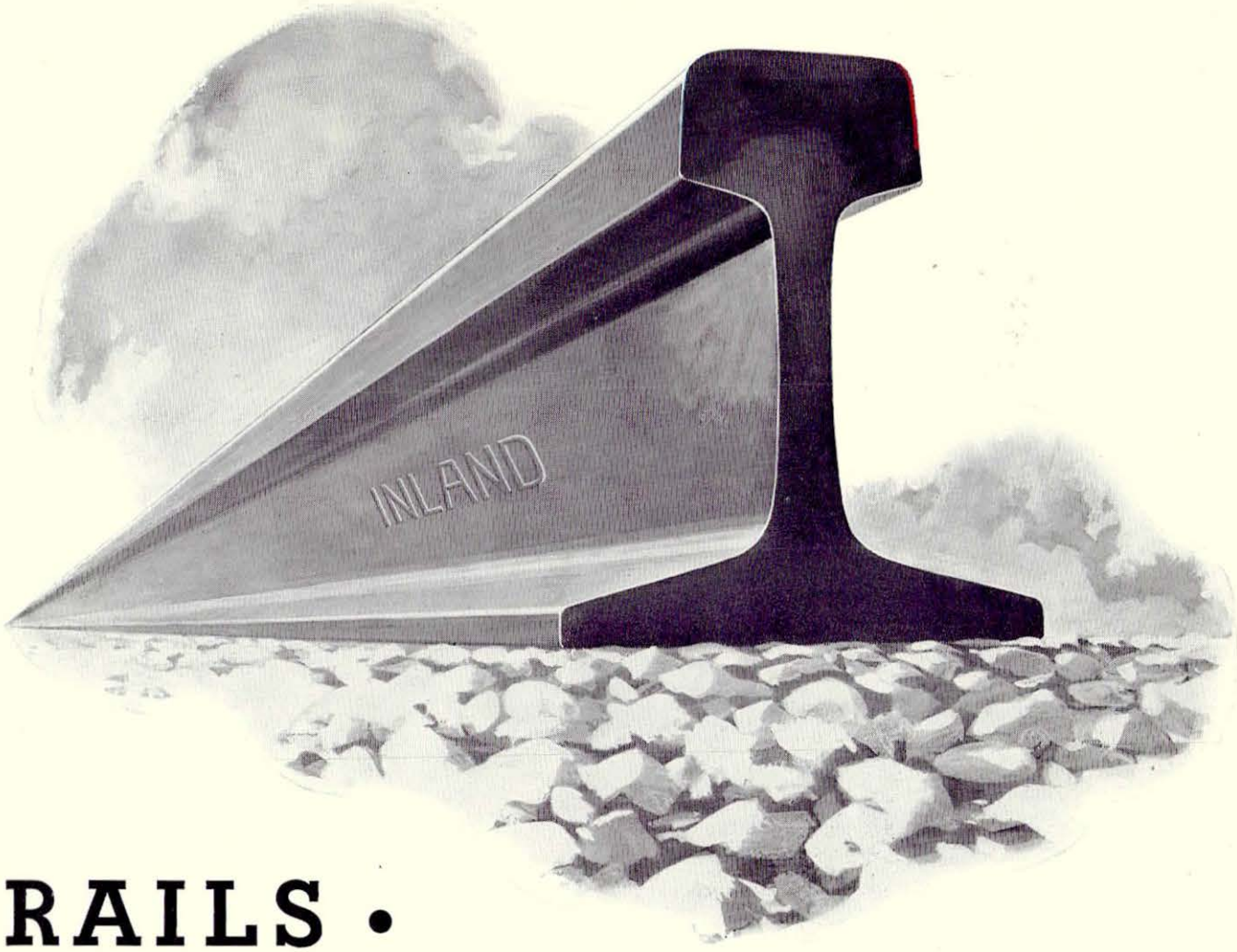
Reproduced from the Railway Age Nov. 7, 1931

FOR COMPLETE SAFETY THE COMBUSTION CHAMBER MUST HAVE ITS OWN SYPHON PROTECTION

●



LOCOMOTIVE FIREBOX COMPANY
NEW YORK CHICAGO MONTREAL



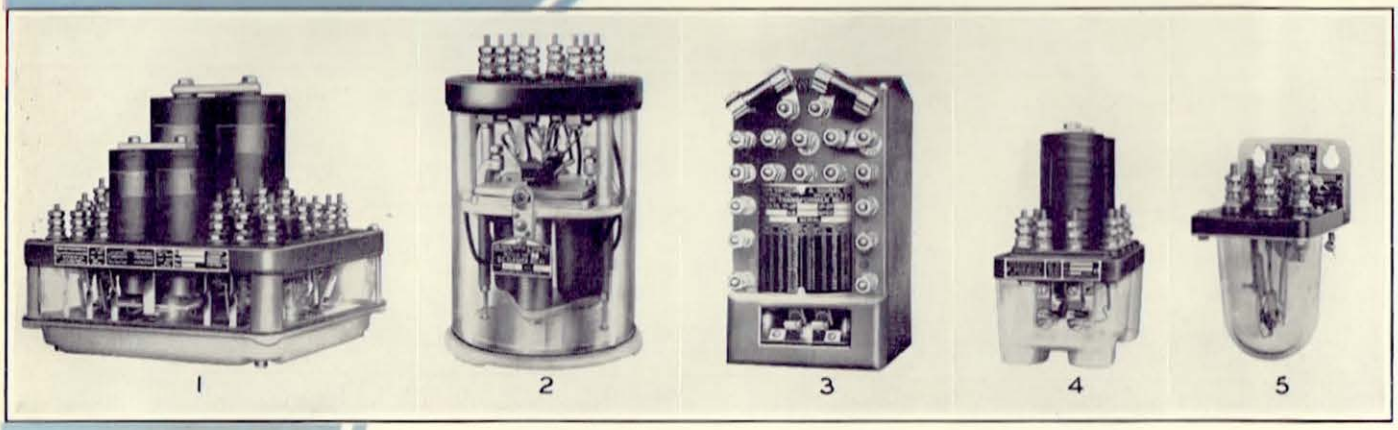
RAILS • ANGLE SPLICE BARS TIE PLATES • SPIKES • BOLTS • • • •

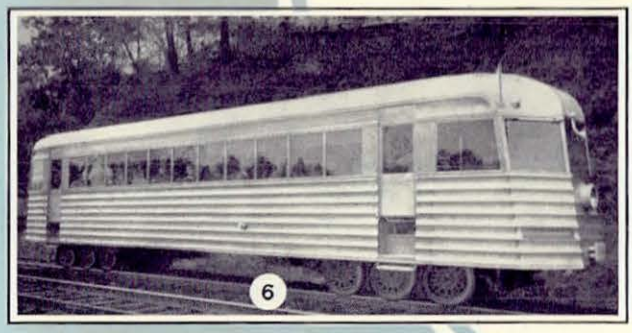
And in addition to these track materials, Inland is your logical source of supply for steel sheet piling, steel fence posts (Red Top), 4-Way floor plates, roofing, bars, plates, structurals, sheets, strip, Copper-Alloy steel, and numerous other steel products. INLAND STEEL COMPANY, 38 South Dearborn Street, Chicago, Illinois.

INLAND STEEL

ABLE SERVANT OF THE CENTRAL WEST

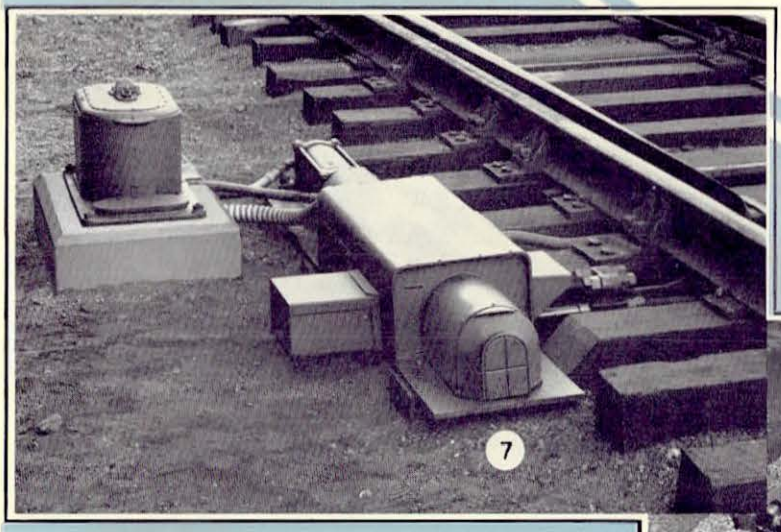
Sheets Strip Plates Bands Structurals Piling Rails Track Accessories Bars Rivets Billets

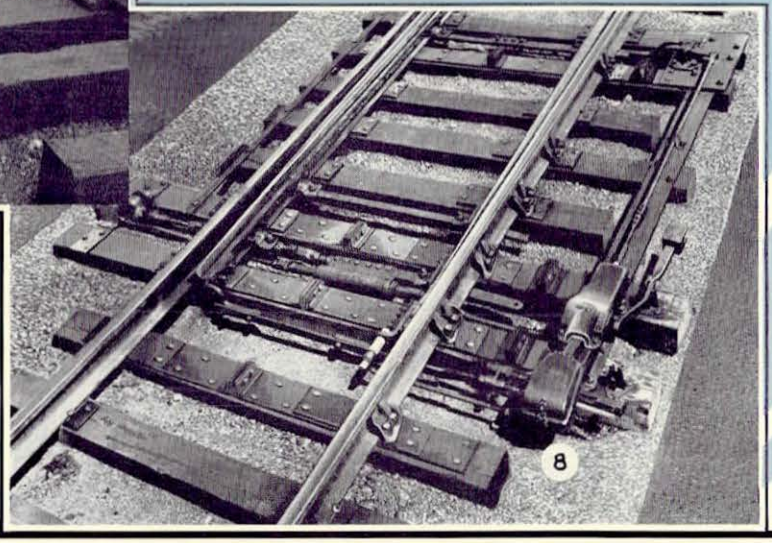




A Partial List of New "UNION" Apparatus

1. DP-20 Retained Neutral Polarized Relay.
2. NF-2 Flasher Relay.
3. ANL-40 Transformer Relay.
4. DN-22 Neutral Relay.
5. TH-10 Thermal Relay.
6. Shunting of Track Circuits by Light Weight Cars.
7. A-5 Electro - Pneumatic Switch and Lock Movement.
8. S-1 Mechanical Facing Point Lock for Spring Switches.





DISTRICT OFFICES

NEW YORK CHICAGO
MONTREAL ST. LOUIS
SAN FRANCISCO

Accelerated Traffic with Increased Safety . . . .

A lower cost per traffic unit is the insistent demand. One method of meeting this demand is to accelerate traffic and increase safety.

"Union" engineering and research must be continuous to provide you with the signaling systems and apparatus required to help accelerate traffic and increase safety.

The result of such continuous development engineering is evidenced by the apparatus produced during the past year, some of which is illustrated.

You expect a signal system to be reliable; to be safe; to be economical in first cost and up-keep and to give good, long-life service. When you specify "Union" systems and apparatus all expectations are met.

Union Switch & Signal Co.
SWISSVALE, PA.

1881 1933

RETAINING

Embankment protected against further washout by Armco Metal Cribbing.

ARMCO Metal Cribbing was developed to meet the need for a retaining wall that could successfully withstand the destructive forces to which this type of structure is subject.

It is particularly adaptable for grade separations, bridge wingwalls, railway embankments, loading platforms and river and harbor bank protection work.

It is a scientific development — modern and practical in every respect — designed to meet these destructive agencies as evidenced by the inspection of crib walls in service in all parts of the United States.

Check over its superiority point by point The tremendous strength is indicated by tests far beyond the extremes of ordinary service.

Durability of the metal is beyond question. Cribbing service is usually less severe than culvert service and Armco Ingot Iron has an unequalled culvert record of 27 years to date.

Armco Metal Cribbing is made from a product of The American Rolling Mill Company, and always bears its brand.

INGOT IRON RAILWAY PRODUCTS CO.

Middletown, Ohio **West Berkeley, Calif.**

Philadelphia St. Louis Salt Lake City Los Angeles
Minneapolis Houston Portland Atlanta Denver
Chicago Dallas El Paso Spokane

(Member of Armco Culvert Mfrs. Assn.)

WALLS OF ARMCO *Metal* CRIBBING

Low cost of installation is attracting attention of railroads at this time.

ECONOMY FEATURE No. 1 Lightness in weight (only 1/10 weight of other types of cribbing) results in low cost transportation, does not necessitate special handling equipment or skilled labor, and reduces construction time.

ECONOMY FEATURE No. 2 Advantages of metal give these savings: No breakage in handling. Does not absorb water and spall or crack. Does not pull apart or break in unstable soils. Pile or caisson sub-foundation not necessary in built-up ground. No curing period necessary.

ECONOMY FEATURE No. 3 100% Salvage Value — Armco Crib Walls may be dismantled and relocated without loss of a single unit. This makes it especially economical for emergency work. Height easily increased by addition of members.

Mail the COUPON

Other ARMCO Drainage Products

Paved Invert Pipe
Perforated Metal Pipe
Part Circle Culverts
Automatic Drainage Gates
MULTI PLATE

Address the nearest office

Gentlemen:

☐ Send more data on Armco Metal Cribbing.
I am interested in a crib wall approximately.....long by.....high.

Name.....

Title.....

Road.....

Address.....

City.....

R. A. 3-18

The LONGEST LIFT SPAN··

AT Boonville, Mo., on the Missouri-Kansas-Texas Railroad's crossing over the Missouri River, bigger and better bridges have succeeded one another since 1874. In 1883 and again in 1894, rebuilding was made necessary by the increased burdens of traffic. Once again, in 1932, there has gone into service a complete new bridge, the fourth to carry the railroad at this point.

The superstructure is remarkable for its extensive use of high-strength silicon steel, as well as for having the longest railway vertical-lift span yet built. This lift span, 408 feet long and weighing 1200 tons, is flanked on the north by three truss spans of 300-ft., and on the south by a 247-ft. truss followed by a 60-ft. girder span over the Missouri Pacific Railroad, the whole resulting in a structure 1638 feet long and weighing approximately 3700 tons.

Design and construction were under the direction of Frank Ringer, Chief Engineer of the M-K-T Railroad, and the steel superstructure was built by the American Bridge Company.

Fabricators and Erectors of Steel Structures of all classes

AMERICAN BRIDGE COMPANY

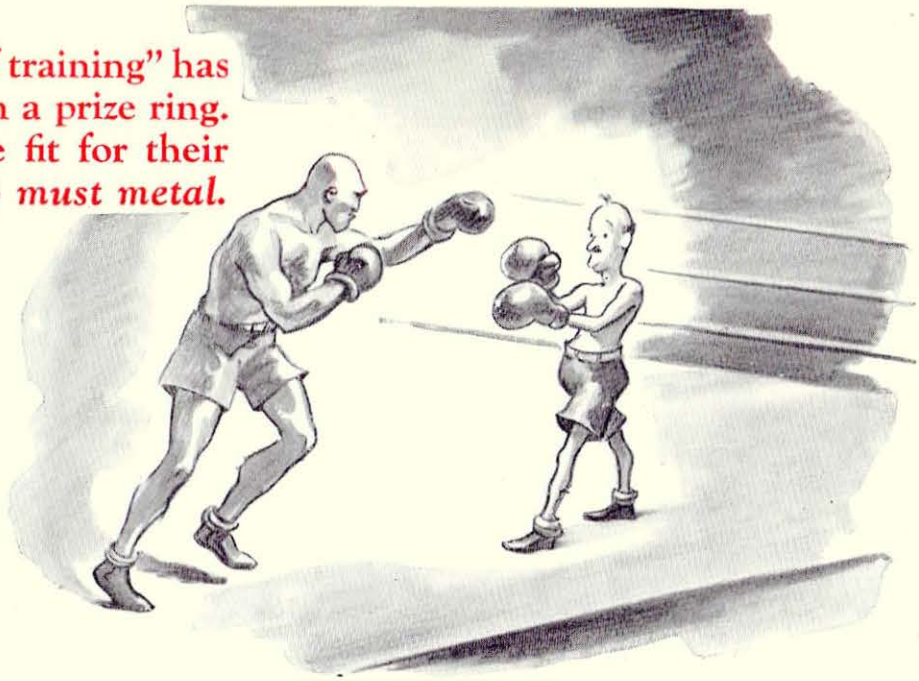
General Offices: Frick Building, Pittsburgh, Pa.

SUBSIDIARY OF UNITED STATES STEEL CORPORATION

Contracting Offices: Baltimore, Boston, Chicago, Cincinnati, Cleveland, Denver, Detroit, Duluth, Minneapolis, New York, Philadelphia, Pittsburgh, St. Louis, Salt Lake City.

Pacific Coast Distributors: COLUMBIA STEEL COMPANY, San Francisco, Los Angeles, Portland, Seattle.
Export Distributors: UNITED STATES STEEL PRODUCTS COMPANY, New York, N. Y.

a man "out of training" has no business in a prize ring. Men must be fit for their jobs—*and so must metal.*



For these TOUGH Jobs—

Pick Metal That Can Take It!

It's all right to put in untried metal—experimental alloys of this and that—when you are looking for only a few years of service, or where service demands are easy. But where metal must LAST under the tough conditions imposed by *specific hard service installations,* you need the PROVED endurance of Reading Puddled Iron.

For the uses described on this page, Reading Puddled Iron stands without an equal. That has been demonstrated by more installations, over a longer period of years, than any other kind of metal can show. Insist on READING for lowest-cost service in these uses. If you need metal for a "hard service spot," write us.

For Staybolts

Reading Bar Iron possesses a fibrous structure found in no other metal. This structure gives Reading Staybolt Iron unique fatigue resistance. Unlike crystalline metals, Reading Staybolt Iron does not snap off sharply.

For Engine Bolts and Engine Bolt Iron Uses

Reading Engine Bolt Iron means *maximum* safety and protection when used for cylinder, frame and stud bolts, safety chain and other important parts for locomotives.

For Equalizer Bars

Reading Double-Refined Iron insures far greater length of service in the uses for which it is recommended, due to Reading's superior methods of piling and rolling. Among these uses are equalizers, forging billets, rivets, high grade chain.

For Chain

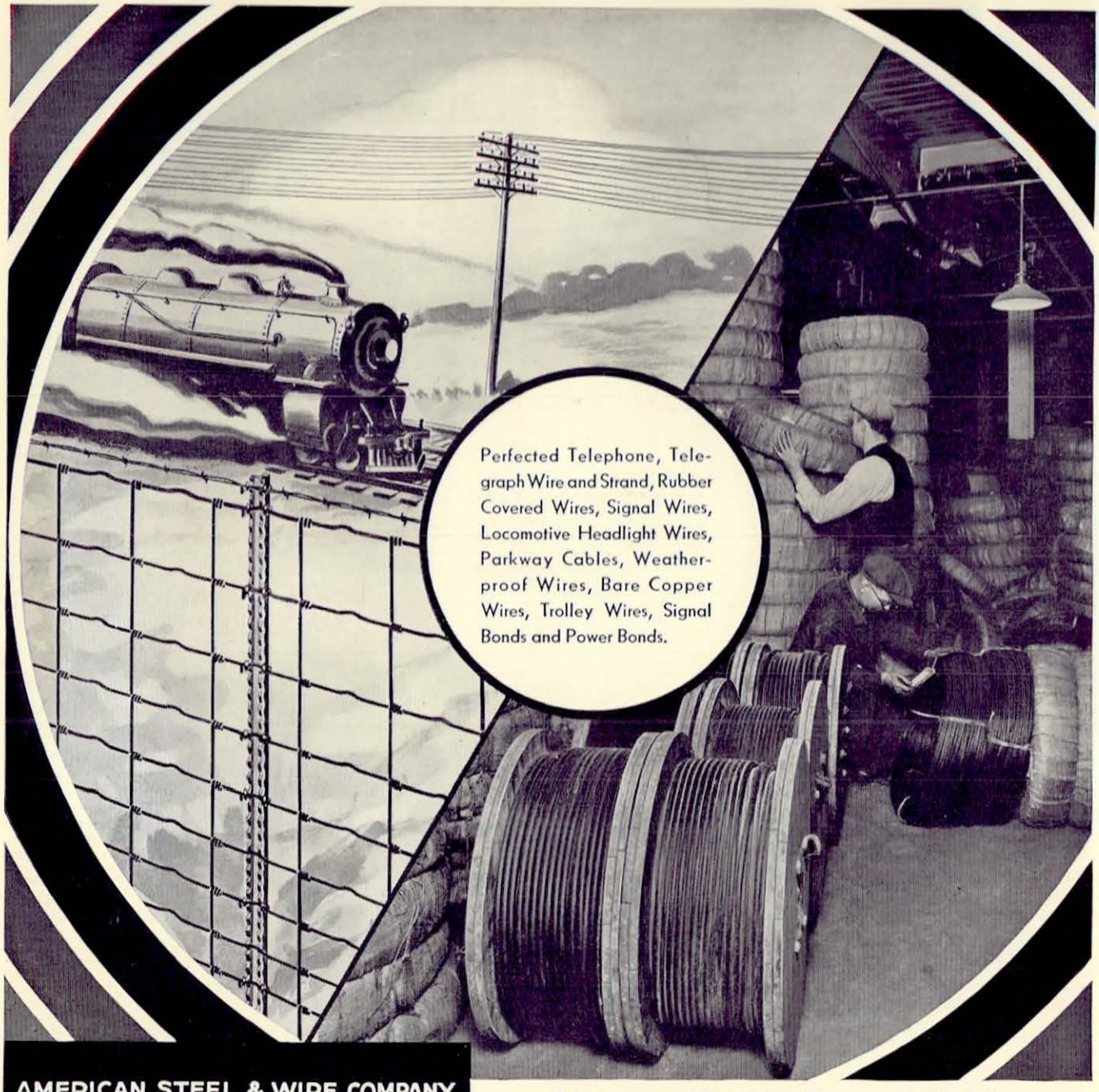
Reading Puddled Iron is furnished in all standard chain sizes. The *fibrous* structure of this iron assures maximum resistance to strain, vibration and metal fatigue.

READING PUDDLED IRON

SINCE 1848

READING IRON COMPANY PHILADELPHIA

Science and Invention Have Never Found a Satisfactory Substitute for Genuine Puddled Iron


Perfected Telephone, Telegraph Wire and Strand, Rubber Covered Wires, Signal Wires, Locomotive Headlight Wires, Parkway Cables, Weatherproof Wires, Bare Copper Wires, Trolley Wires, Signal Bonds and Power Bonds.

AMERICAN STEEL & WIRE COMPANY

ELECTRICAL WIRES AND CABLES

Known To Be Dependable

In warehouse and store room, supervisors appreciate the convenience of dealing with one source of supply instead of several, with one high standard of quality instead of several. Men on the right-of-way know what it means to work with products that are known to be dependable, that make their own efforts more valuable.

American Steel & Wire Company Electrical Wires and Cables are recognized for dependable service at low cost. Our engineers are familiar with the needs of the railway field and the importance of an efficient, uninterrupted schedule. We can furnish Electrical Wires and Cables for any purpose.

1831 MORE THAN 100 YEARS of PROGRESS IN WIRE MAKING 1933

AMERICAN STEEL & WIRE COMPANY

208 South La Salle Street, Chicago
94 Grove Street, Worcester

SUBSIDIARY OF UNITED STATES STEEL CORPORATION
AND ALL PRINCIPAL CITIES

Empire State Bldg., New York
First National Bank Bldg., Baltimore

Pacific Coast Distributors: Columbia Steel Company, Russ Building, San Francisco

Export Distributors: United States Steel Products Company, New York

No longer ARE BOILER CONDITIONS THE DETERMINING FACTOR IN LOCOMOTIVE SHOPPING

Proper water treatment so increases the life of flues and sheets that the condition of the boiler is no longer the determining factor in shopping motive power.

Extensions beyond the Federal four year limit, with mileages of more than one-half million miles are being secured with Sodium Aluminate Water Treatment, with resultant savings in mechanical and operating costs.

Sodium Aluminate (Nalco System) Treatment is complete. It removes and prevents scale formation . . . stops pitting and corrosion . . . effects rapid coagulation . . . decreases foaming and blow-downs.

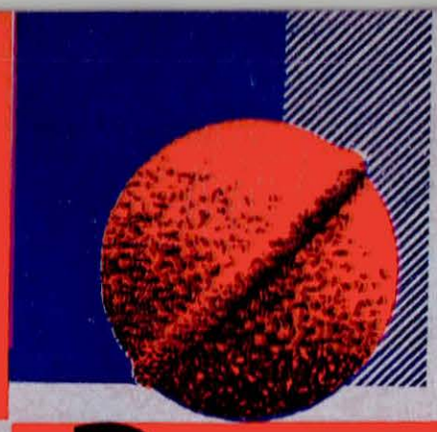
And—Sodium Aluminate Treatment is inexpensive whether for use with lime and soda ash at existing softeners or for wayside treatment. The cost of installing and operating Nalco equipment is so low that nearly all water supplies can be treated with profit.

● A certain road started using Sodium Aluminate Treatment in 1923. In that year the boiler shop applied 45,648 two inch flues. In 1931 but 5247 two inch flues were installed and the road received all the Federal extensions for which it applied.

NATIONAL ALUMINATE CORPORATION
6216 WEST 66TH PLACE . . . . CHICAGO, ILL.

SODIUM ALUMINATE

NALCO SYSTEM



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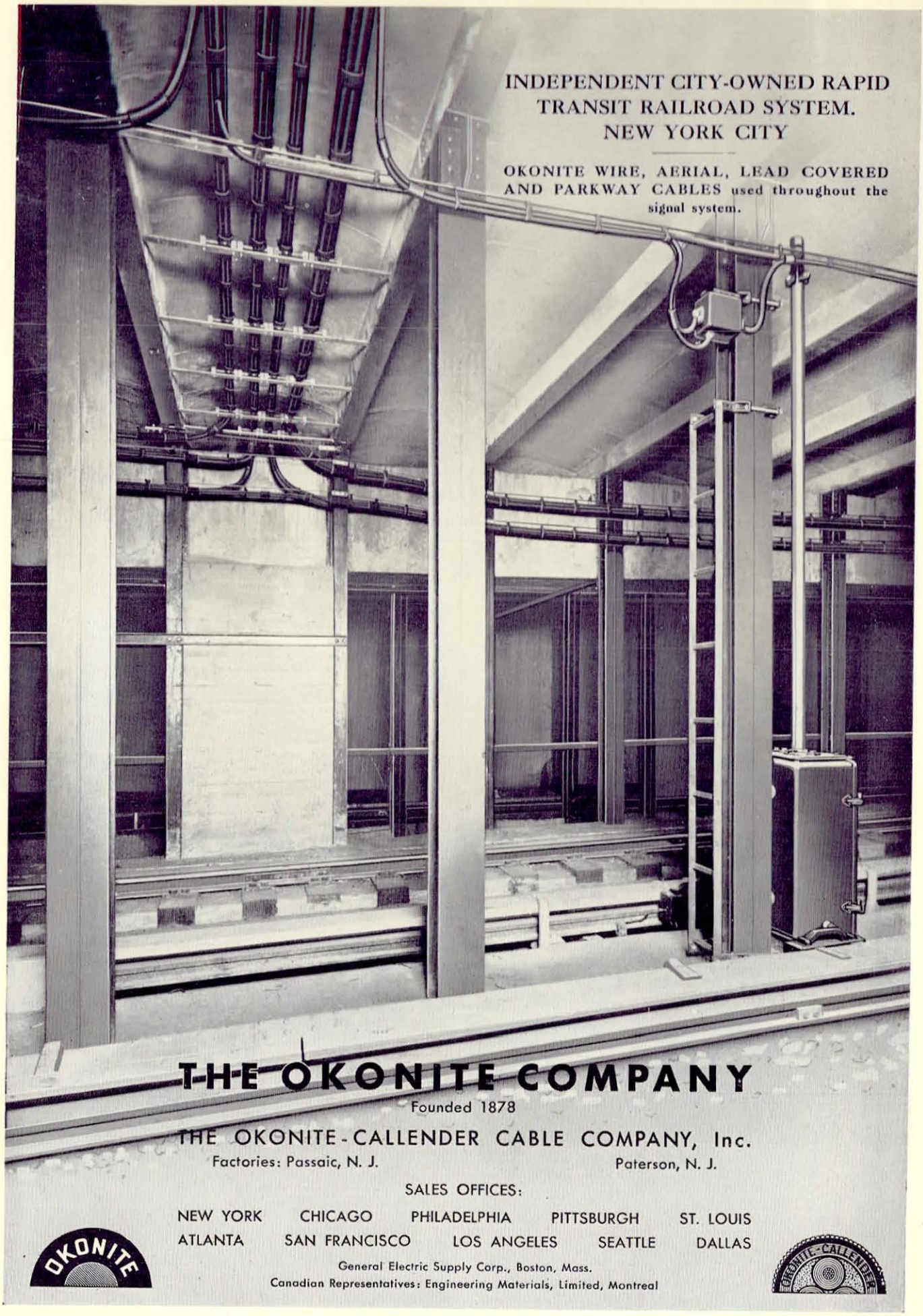

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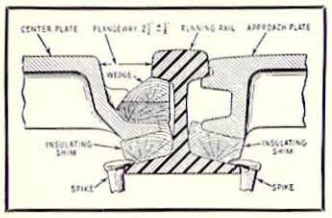

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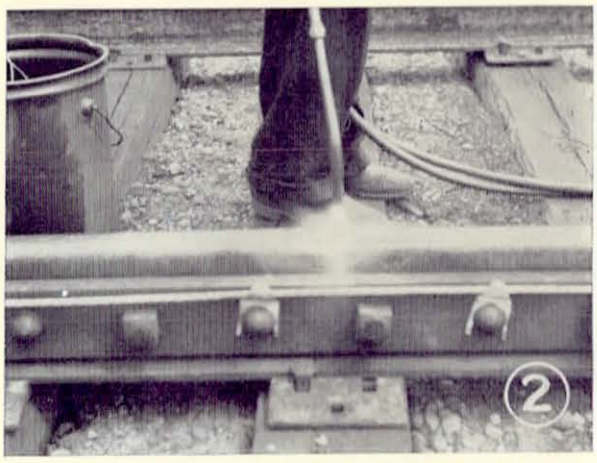

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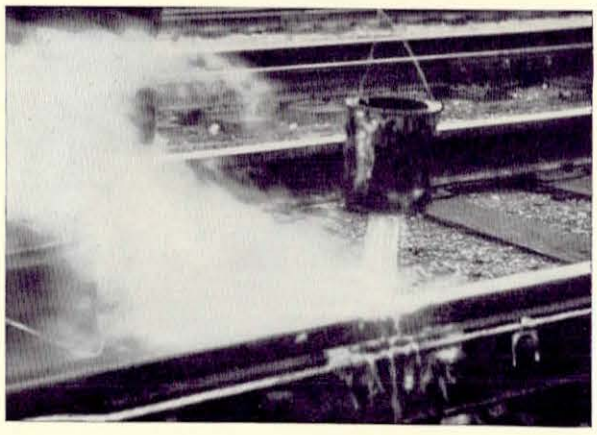

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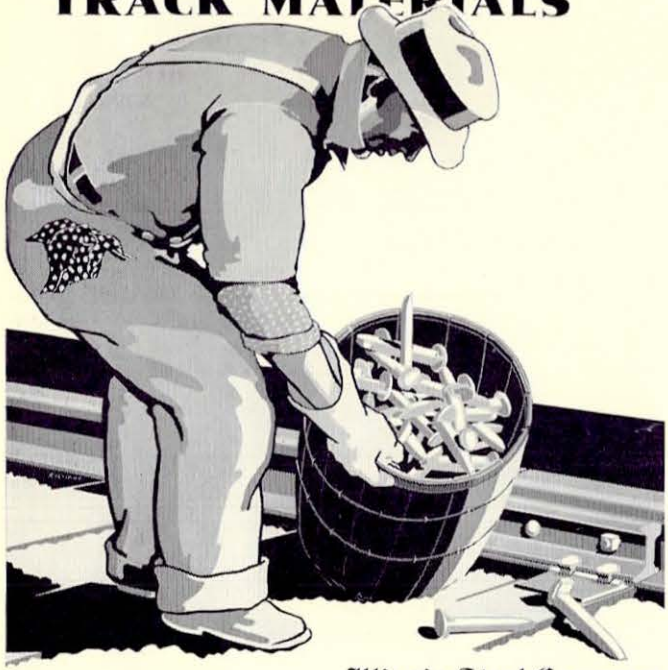

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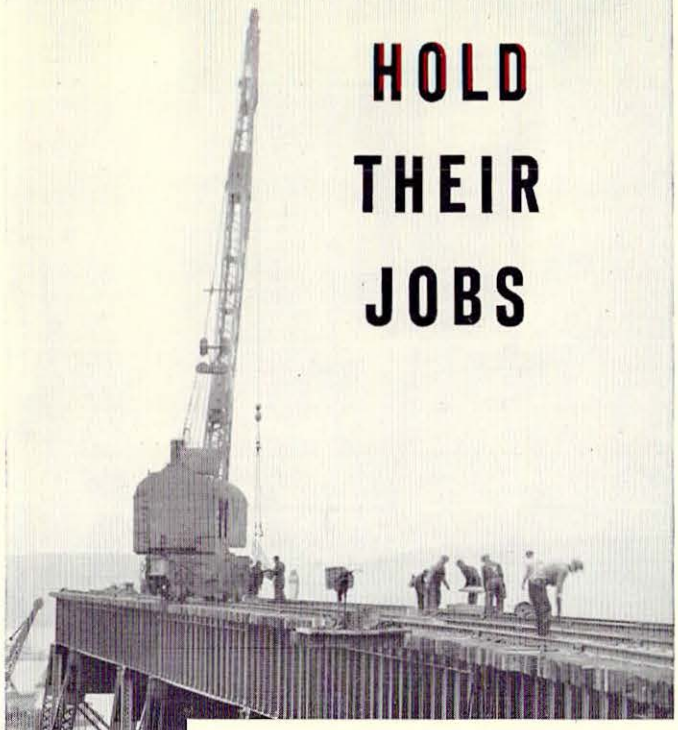

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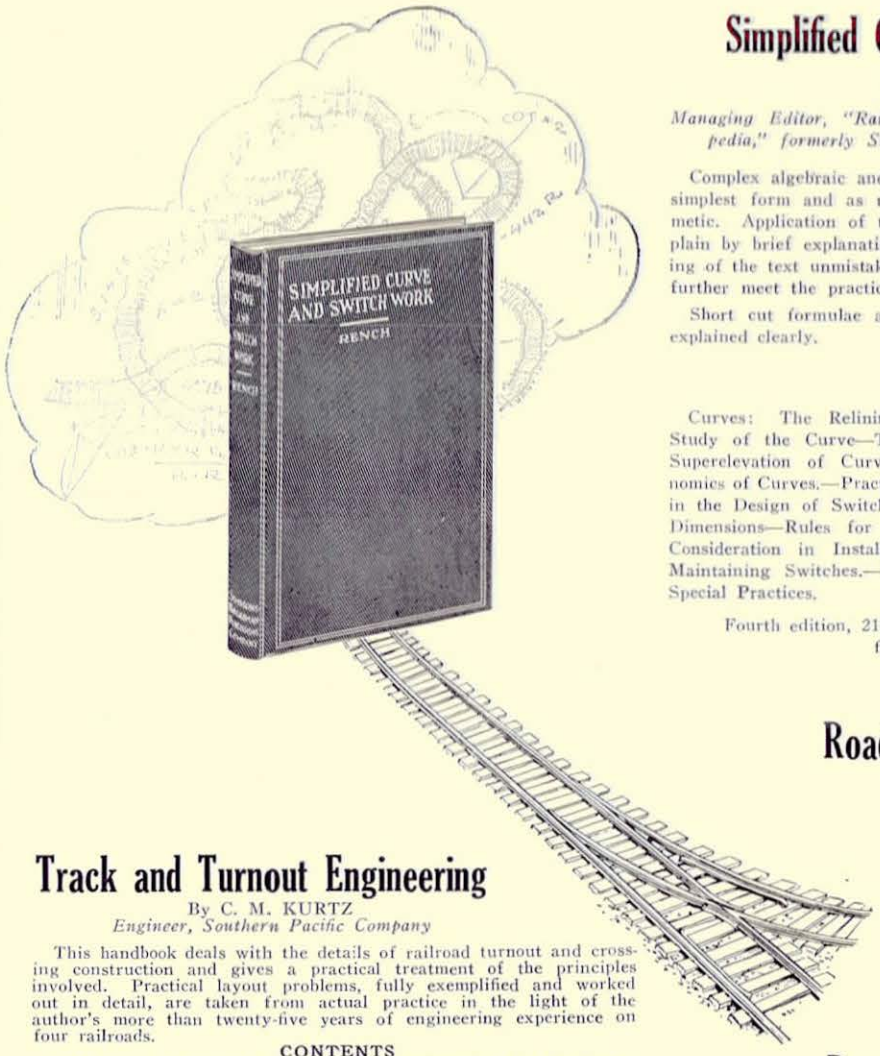

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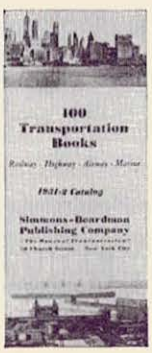

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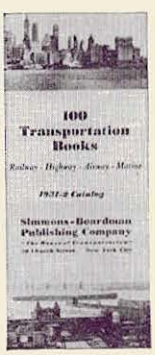

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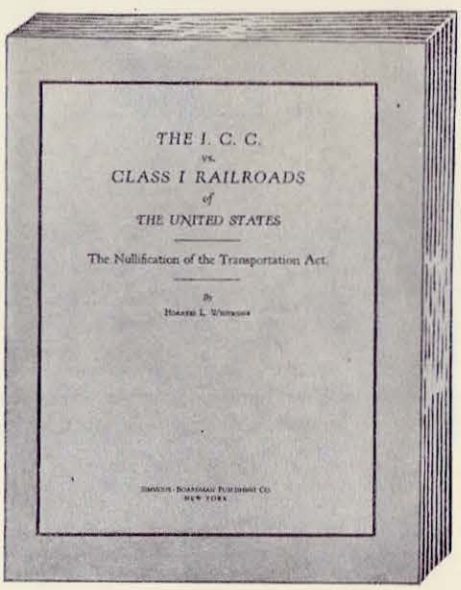

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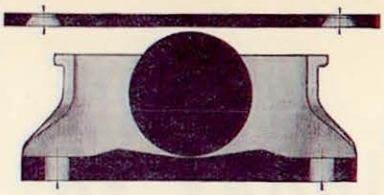

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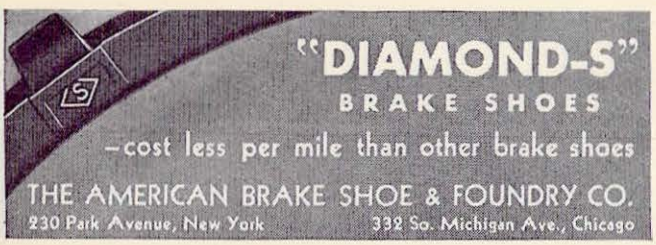
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—cost less per mile than other brake shoes
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All Railway Equipment, Structures and Materials
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Use space in this section

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THE Railway Educational Bureau, Omaha, Neb., offers a distinctive education service for Supervisors and other employes. Write for FREE Special Bulletin.

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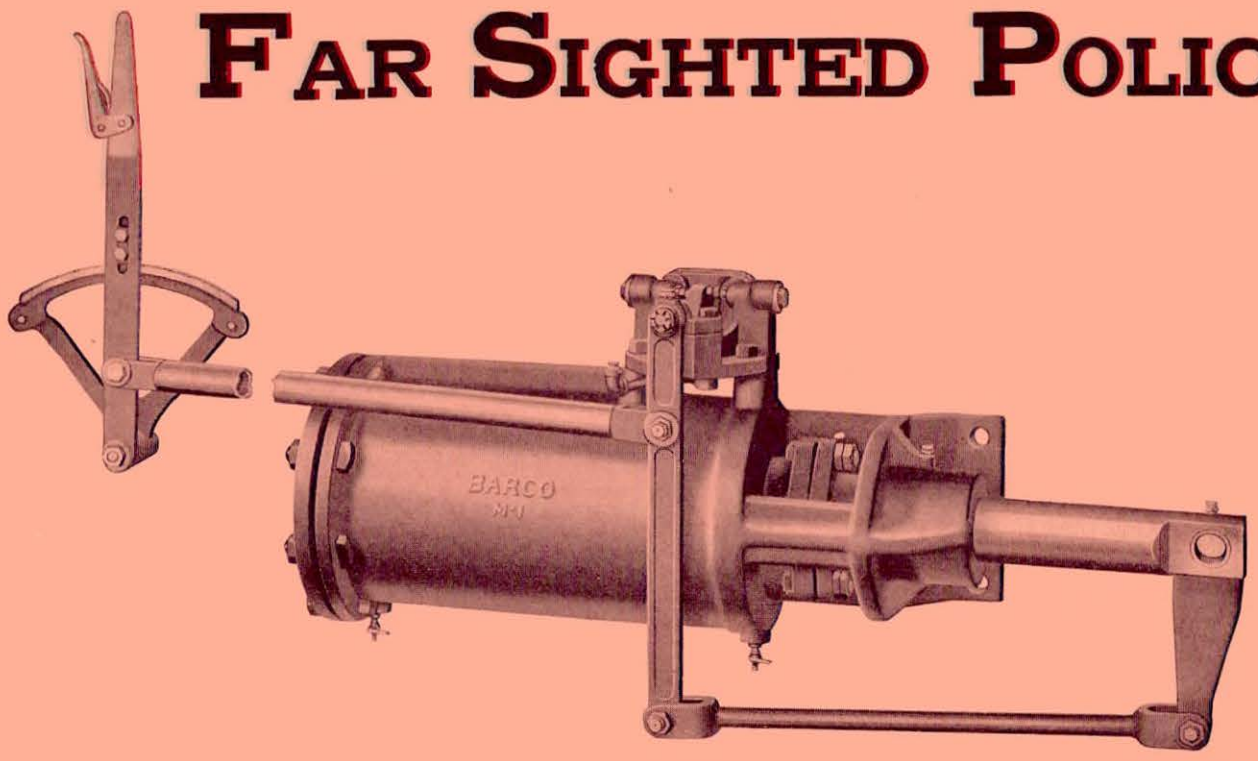
FAR SIGHTED POLICY



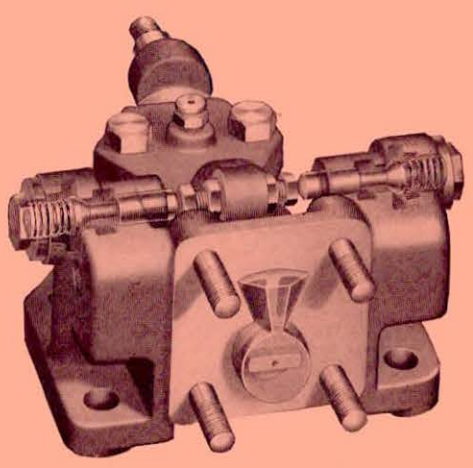
IN REVERSE GEAR SELECTION-

should consider the fact that while Reverse Gears may be purchased and applied to some unimportant power or to power that may be retired in a few years, the Power Reverse Gear should be selected that will give long trouble-free service with low cost of maintenance on large as well as small power.

Power Reverse Gears thus selected may later be used for replacement on more modern power, making a permanent investment for the Railroads.

Transferring present old or unsatisfactory gears to old power and applying new gears "if properly selected" to modern power may easily prove to be a paying investment.

The Barco gear with the new dual control valve and integral cast piston rod guide allows closely maintained selected cut-off and reduces packing maintenance.



Interior BARCO Dual Control Valve

Barco Power Reverse Gears provide

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Barco Manufacturing Co.

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THE HOLDEN CO., LTD.

In Canada
Montreal—Moncton—Toronto

In Canada
Winnipeg—Vancouver

BARCO

THINGS TO DO NOW*

EARLY this year the Missouri Pacific spent $5,100 for the installation of a remotely-controlled power switch and signals to replace a mechanical interlocking at an end of double track, which will reduce operating expenses $5,000 a year.

The Alton installed an automatic interlocking last summer to replace a mechanical plant at a crossing, at a cost of $8,000, which will save $6,000 a year.

The Louisville & Nashville installed A.R.A. standard flashing-light crossing signals in place of gates at six street crossings in an Illinois city at a cost of $8,990, and effected an annual saving in operating expenses of $10,954 in addition to affording protection for the full 24-hr. period, whereas the gates were in operation only 18 hr. daily.

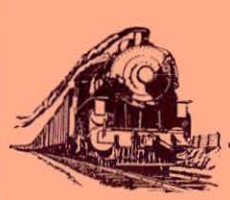
In replacing a 26-lever electro-mechanical interlocking which had been destroyed by fire, the Pennsylvania installed a remotely-controlled C.T.C. type of electric interlocking which effected an annual saving of $5,203 on an investment of $7,539 over and above the estimated cost of rebuilding the facilities destroyed.

These expenditures illustrate a type of improvement which some railways are continuing to make in these days and which are yielding returns of as high as 50 to 100 per cent on the investment. Such savings are independent of the number of trains and the returns will continue year after year.

*Railway Age Editorial, December 17, 1932.

UNION SWITCH & SIGNAL COMPANY
Swissvale, Pennsylvania

GENERAL RAILWAY SIGNAL COMPANY
Rochester, N. Y.



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Signals Aid Modern Motive Power to Produce More Ton-Miles Per Train-Hour